

Authentic



SCIENCE FICTION MONTHLY

1'6d.

No 48

This month's
FEATURED NOVEL
**TABARNI
DOCUMENT**
by TOM CARSON

Our Starship at its destination

Short Stories by: **C. V. JACKSON, T. D. HAMM, H. WARNER JNR.**
Features by: **FRANK WILSON, H. J. CAMPBELL, JOHN TAYNE**

VOLUME I No. 48
ONE SHILLING and SIXPENCE

Authentic

SCIENCE FICTION MONTHLY

Editor:
H. J. CAMPBELL,
F.C.S., F.R.H.S.,
M.S.C.I., F.B.I.S.

Associate Editor:
W. HOWARD
BAKER

Art Editor:
JOHN RICHARDS

Illustration by
DAVIS

Cover by DAVIS

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H. J. CAMPBELL

Writes...

I think we've done rather well with the line-up this month. Our lead story is in rather a different style from usual, but intriguing, nonetheless. Tom Carson is a newcomer to these pages; when you've read his *Tabarni Document*, let me know if you want him again.

Recoil is a powerful little tale by another author who is new to you—H. Warner, Jr. I really believe that almost everyone will like this story, and that says a lot for it. (Now don't go and tell me you hated it just out of cussedness!)

Veronica Welwood, another new author who gives us *Last Journey*, is an Australian lass who has been reading *Authentic* for quite a while, liking it and wanting to write for it. I'm very glad to welcome her among the growing ranks of readers turned contributors,

and hope that she will give us some more of her stuff.

It does give us great pleasure to introduce new authors to the field, and we tend to feel that we've certainly done our share. Whereas some science fiction magazines, both here and in the States, go on printing stories by the same old people—under the same or different names—we are continually adding to our writer-list. Of course, some turn up more frequently than others, but that's because you like them more. We now have a sizeable team of regular contributors, all of whom made their science fiction debut in this magazine. The more the team swells, the more we have to stop our head swelling!

New author is a label we cannot apply to Thelma D. Hamm, who wrote the little piece called *Servant Problem*.

Thelma has been making quite a name for herself in the States with these short pieces. Very few people can write on such a small canvas with such neat effect. Maybe you remember her story in my anthology, *Tomorrow's Universe*? She wrote *Servant Problem* especially for *Authentic*. Do tell me how you like it.

On the non-fiction side we are also building up a fine batch of regular writers. Frank Wilson is here again with his logic series. This will soon turn into a series on scientific method, telling you how it is that scientists go about finding out things. John Tayne keeps cropping up lately and he is back again this issue with a masterful piece on evolution. Many readers have asked for an article on this thorny subject; I hope you will agree with me that John has successfully removed the thorns. Another non-fiction writer who seems to be carving a niche for himself in our pages is C. V. Jackson. You will undoubtedly remember his piece on medical progress in the future. Some correspondence about this from a doctor is printed on pages 121-123. And Jackson gives us an interesting article on inventions, not great but small, in

this issue. If you want to follow the advice he gives, write to him, not me! (Unless you've got an invention for editing a magazine with utter perfection.)

The first in the series on fan clubs appears on pages 105-106. This one is about the London Circle. Don't forget that if you want *your* club written up, send me all the information you can about it. All part of the service.

Our Great Man this month is John Stuart Mill, the philosopher. A queer man was Mill, mixture of genius and complete idiot. You can read about him on pages 119-120.

Supporting features, as usual, are fanzine reviews, book reviews and projectiles. Not a bad bit of variety, I think. I'm trying to cover as wide a field as possible in this non-fiction material. Got any ideas?

This month sees the last of our present cover series, loth as I am to see it stop. But we've got quite a good series to follow—a tour of the solar system, planet by planet, in a way that's never been done before. Trust *Authentic* to be different, but good, eh? See you next month.

H.J.C.





From the earliest days
of the solar system,
translated and edited
by

TOM CARSON

comes—

TABARNI DOCUMENT

THE last grey dawn of his life had come, but he paid no attention to the light which came through the window of his cell. He wrote quickly, striving to finish his testament. He was strangely tranquil.

At last the final word was written. He laid down the blunt stub of pencil and riffled the sheets of paper. He looked up as the door of the cell was unlocked and two guards appeared. One of them stretched out his hand and grasped the sheets of paper.

"This will be destroyed," he said.

As the guard set fire to the laboriously written testament the prisoner's dull eyes contracted slightly. That was the only sign of the ember of rage in his mind.

"Get up," said the other guard. "The time has come for your death. Follow us." He prodded the prisoner's ragged body with the snout of his hand-weapon.

Wearily the shrunken man

rose to his feet. He did not spare the bare cell a final glance. Already his mind was filled with a shifting gallery of faces, the faces of his friends. How few they were! Yet he was fortunate in that day and generation to have had so many.

The prisoner walked down the corridor, flanked by his guards. He did not see them. He saw only the faces in his memory. The jolt of a guard's elbow in his ribs roused him to the fact that a high officer of the Fighters stood before him.

His tired eyes focussed on the crisp, drab uniform of the little man. The small face swam slowly into his consciousness. Even on the threshold of death he felt his pulse quicken in recognition.

The high cheek bones, the cold eyes and the cruel mouth were unmistakable. The prisoner had seen this officer's image many times. This was Takato, Marshal of the Fighters, the greatest killer of the age.

The killer and the rebel faced each other for a moment, a moment outside time. The marshal recognised the condemned man as a har-binger of an era in which there would be no place for brilliant exterminators.

Marshal Takato spoke to one of the guards: "What papers have you there?"

"The political testament of the prisoner, sir," replied the guard. "As is usual, I attempted to destroy it, but some of the paper did not catch fire immediately."

Takato stretched out his fine-boned hand and took the charred wafers of paper. Petals of ash fell to the floor. Pencil marks upon them gleamed silver for an instant.

The marshal motioned the three men to proceed. Then he walked to a nearby office. He sat in a prim chair and spread the fragments of the testament on a chased table. He fingered the scraps of paper, reading a sentence here and there. They said nothing new.

Takato and his Fighters would be defeated. Evil would vanish from the planets. All thinking beings would be free. The old, old, stifled yearnings of the heretics. The marshal chided himself for wasting his time. He could find such slogans on any wall where heretics risked death with hasty pencil scratches.

He was about to sweep the tatters of this mute vision into a canister when his eye was caught by a piece of paper no larger than an apple slice with a brown rind. It bore three sentences:

"Takato will make his son powerful. But every man must hand on life, not death. Therefore Takato's son will destroy his father's works of death."

A guard knocked at the office door.

"The prisoner has been destroyed, sir," he reported.

Takato nodded, rose from his chair and left the room. With him he took a fragment

of paper bearing three sentences.

"YOU INTRIGUE me, Hunt," thought Dakers, focussing his attention on a glass some three metres away. It floated from the table into his hands.

"What I think is all too true," continued Hunt, lying back in his chair, his eyelids closed. "The boy is a phenomenon." He sipped his drink and went on thinking. "Whether he is an ape or a genius I don't know."

"This boy," signalled Dakers. "I don't think I've met him."

"Possibly not," replied Hunt. "His father dumped him in here at the beginning of the term. The Head asked me to tutor him and help him catch up with his corps. He wasn't here a week before he was abreast of the other boys—in some things."

"Where does the problem arise?" asked Dakers. He passed a hand over his glass and the liquid became cloudy and cold.

The electronics master sat forward in his chair. His florid face was grave. He lowered his thoughts and transmitted: "This boy, this Takato. One can only call him a peace lover."

There was a shocked thoughtless interval in the study.

"What, precisely, makes you think that?" signalled Dakers. The glow of friendliness had gone from his mind. He had slipped back into his role of College Thought Guardian. "Come, man. Think out!"

Thought Hunt: "The other evening young Takato had just finished punishing my brains after a strenuous tutorial. There were sheets of integrals and vectors all over the table. We stopped work and began to think of various matters—the ball game, the rocket ramp project, the satellite rebellion . . ."

Dakers' negroid features took on a look of keen anticipation.

"... We discussed the liquidation of the satellites' Fifteenth Group in the Metra ambush the other week. Takato expressed sympathy for them. He gave as his opinion that one could appreciate their Private Thought aspirations. I was quite embarrassed."

"Go on," pressed Dakers.

"Takato went on to deplore the fundamental concept of aggression. I pulled him up sharply and cautioned him about irresponsible thoughts. He ignored me and thought quite bluntly: 'I admire peace.' I immediately dismissed him and he faded into his Beta frequency. I felt very troubled."

"Why did you not report this at once?" demanded the Thought Guardian.

"One must be sure. I intercepted thoughts from the other boys next day and discovered that Takato had been acting very queerly. Some days ago four seniors were beating a junior against the wall at the end of Lab Three.

A normal piece of bullying. Yet Takato attacked the four seniors without warning. He felled one, while the others were engaged with the junior, and was about to do the same to another when the rest of the seniors turned their attention on him. The junior disappeared. When he was asked why he had interfered, he replied that he was challenging their 'lazy attitude.' Those were his exact words."

"Remarkable!" signalled a mind which was not Dakers'.

The two masters sprang to attention. The Head had suddenly materialised in the study, translating himself into his Alpha frequency, unannounced and uninvited.

He motioned them to resume their seats and attracted a seat to himself. Relaxing on it, he explained: "I could not help intercepting your thoughts, gentlemen."

As the Head's deft fingers arranged his lilac gown the masters realised he had used

his voice, not his thoughts. The Head fixed them with his flinty gaze.

"I think it would be best if we spoke," he said. "I do not wish our conversation to be intercepted. All the audio-circuits function in my room, so what we say will be secret. You realise, of course, that this boy is someone special. Does his name not mean something to you?"

The masters shook their heads.

"You have heard of Marshal Takato, I presume?" said the Head dryly.

Dakers stammered: "But surely . . . this boy . . .?"

"The boy is Marshal Takato's son," affirmed the Head. "The marshal and I were acquainted during our college days. Why else do you think he sent his son to this little college on this little barren planet? Oh, I mean no discourtesy to you, gentlemen. But it must be admitted that this school does not rank amongst the foremost in the

solar system. Why else, except for friendship's sake, would the greatest military genius in the system choose to send his son here?"

Dakers was deeply offended by the Head's remarks. He took particular pride in the uniform mental bearing of his boys. But his resentment was modified by the knowledge that the Head was acquainted with Marshal Takato.

Takato, the only Terrist to attain high rank amongst the Fighters, had changed the whole concept of warfare. Takato had said: "Century after century our space vehicles have moved along routes pioneered by rockets five hundred absolute years ago. One would think we were running a transport service instead of a destructive force. Our task is to let blood, to mutilate, to cripple, to terrorise, to wreak vast havoc, not to ferry milk to satellite babies."

Under his brilliant strategy the proud satellites had been forced to meet the Fighting

armadas. Decimated, they had been driven into the Sterile Belt to shrivel in its radio-activity. Mars had been converted into a great military base. The Lunics worked in thousands of underground cells to produce the vast quantities of atomisers, deflectors and static projectors needed by the Fighters. The populations of the Moon and of Mars increased rapidly as the standard of living rose.

That a Terrist, such as Takato, should be so popular was surprising, for the Terrists had so shrunk in systematic esteem that they were regarded as fit only to deal with education, culture and entertainment. Few Terrists entered the ranks of the Fighters, and few Lunics or Venusians wanted to. The Fighters were Martians almost to a man,

Takato had joined as a cadet. He had consolidated his position by marrying a Martian female, and had swiftly risen to high rank. Now he had unbounded

power to dissipate energy by every aggressive means he could conceive.

Dakers, who was proud of his own almost pure negroid descent, regretted only that such a fine Terrist specimen as Takato should have seen fit to marry out of his own race.

THE BOY Takato materialised from his Beta frequency in the study.

"You wished to see me, sir?" he signalled.

"Yes," replied the Head. "And if you don't object, young man, I think it would be better if we conducted our conversation in speech."

"As you wish, sir," the boy answered. His voice was surprisingly rich for one in his teens. He had typical Nipponese features, fine and inexpressive. His eyes were brown and cold like pellets of rock salt.

His little hands fingered his green student's gown as he sat in the seat which the Head had indicated.

"You do not deny that you expressed an admiration for peace?" asked the Head.

"No, sir."

"You do not deny this amazing intervention in the activities of senior students?"

"No, sir."

"Further, you do not deny that your reason for this unwarranted interference was that the seniors had adopted—and I use words attributed to you—'a lazy attitude'?"

"Those were my words, sir," replied Takato.

The Head brought his fingertips together: "What is so 'lazy' about bullying a junior?"

"Well, sir, any fool can be a bully. It's natural. And being natural is lazy. Suppose the junior had bullied the seniors. That would have been unnatural . . ."

"It would indeed." The Head nodded.

". . . and so it would not have been lazy, sir."

The Head's voice was dangerously soft: "And what is wrong with being lazy?"

Takato recited rapidly: "Article Five of the Solar Catechism says, 'Only the furious expenditure of energy can justify existence in the solar system.'"

"You are an intelligent being, Takato," purred the Head. "Do you really believe that article of the Catechism?"

"No, sir," was the calm reply.

Dakers' scowl became a snarl. Hunt shifted uncomfortably.

"In fact, Takato," went on the Head, "you quoted this article only because you consider us to be less intelligent than yourself."

"Quite, sir."

Dakers lunged forward in his chair. "Sir, this insolence is too much. The heretic deserves death."

The Head fixed his gaze on the small figure before him. "You understand what you have said and done. Yes, I see you do. And I should be obliged if you would wipe that smile from your face."

He calmed himself, then went on: "You know you have forfeited your life. You know that in the normal course of events I should have no hesitation in killing you here and now and consigning your cadaver to radio-activity. But arrogant, contemptuous, despicable heretic that you are, you realise you are not here in the normal course of events. You know very well that your father and I were friends at college. And you count on your father's fame and my friendship to save you from the fate you so thoroughly deserve."

A vein throbbed beside the silver thatch of his hair. The monkey-like figure of the boy did not stir.

"Takato," cried the Head harshly, "you will find that you cannot trifle with the beliefs of the system in this way. You will find that there is nothing so terrible as the anger of the system when you challenge its basic concept of aggression. You may attempt, coward and rebel that you

are, to hide behind that illustrious man who must own you as his son. But you will find that dishonourable death and eternal obscurity will be your fate. You will be forgotten, blotted out, erased. There will be nothing to show posterity that such a creature as you ever existed."

The Head had stopped. The vaulted walls of the room enclosed the little group as the shell of a nut enfolds its kernel. Only the soft whisper of the air-conditioning unit broke the silence.

Takato's voice was courteous and calm.

"And what exactly do you propose to do, sir?" he asked.

MADAME TAKATO turned as the robot servant spoke in its metallic voice: "Madame, Son Takato has arrived."

"Show him in," said the Martian woman, laying down the pretty viewing box in which she had been watching the Martian translation of a classic Terrist story.

"Here I am, Mother," said the boy as he entered the room. He held out his arms to his mother. She smiled, held him close and kissed him. Gently he disengaged himself.

"I have a lot of luggage," said the boy. His mother tapped an amber panel and a robot appeared. She ordered it to remove the boy's belongings. "And prepare his bed," she added.

She studied the small lithe body of her son as he settled on one of the rest platforms which floated a metre above the floor of the Martian room. He returned her gaze inscrutably.

"Well, how does it feel to return to Mars in disgrace?" she asked teasingly.

"It feels good to return from the Sterile Belt in any manner," he replied. "Oh, how those dreary old teachers talked and talked! Big words all the time. Big words and small minds."

She laughed. "I see you have not lost your humility.

Have you nourished yourself yet?"

"Yes. I dined in the orbital rocket. Where's father?"

A shadow crossed the woman's face and she twisted the viewing box in her hands.

"Son," she said, "promise me that you will be careful what you say to your father. I'm surprised that he took your escapade as he did, but he is a strange man. He may have brought you home only to punish you in some other way."

A robot appeared between two stalker entrance columns. "Marshal Takato is here," it said.

Mother and son rose as the small killer in his ugly grey uniform entered the brilliantly-lit, peacock-coloured room. He bowed quickly, as did they, kissed his wife's hand and said: "Food."

"Yes, my lord," said Madame Takato. She tapped a green panel and a robot appeared bearing a tray. It

bowed before the marshal and left the tray floating before the rest seat on which he had perched himself.

"Go," said the marshal to his wife. With a quick, nervous smile at her son she left the room.

The marshal ate his Terrist meal in quick gulps and then lit a pungent Venusian weed. He looked at his son.

"Home?" he remarked.

"Yes, father," said the boy. He attracted a rest seat to him and was about to sit down.

"Remain standing," the marshal snapped.

He blew out a cloud of smoke and said: "By now you should be dead. How long have you lived in the system?"

"Two absolute years, father."

"Fifteen Terrestrial years. By now you should know the systematic beliefs and what happens to those who challenge them."

"Yes, father."

"You have earned death. There is no doubt of that.

Please understand that every minute you remain in the system is a gift granted to you by the Council because of my intercession. You will work to redeem yourself, so that when your usefulness is ended you can be destroyed with honour. I have exceeded my time limit in the system by five Terrestrial years already. You know why?"

He leaned forward and stabbed the air with the glowing stub of his weed. "I have exceeded my time limit because I am now so powerful that I can defy the system. That is why I still live."

"But, father. My crime is that I have defied the system. Surely . . ."

"Yes, but you have no power. Strong rebels make the laws. Weak rebels attempt to break them and are themselves broken. Stand to attention while I speak! I have spared your life for reasons of my own. You were sent to college in the Sterile Belt so that I could test your

nature. I wondered how you would behave in that hive of orthodoxy. My fears have been confirmed. You are indeed my son, except in one respect. Like me, you think for yourself. Like me, you have challenged the system. But, unlike me, you have not made certain of your chances of success."

The boy licked his lips. He was puzzled. "But father, surely you disapprove of my views. I thought you agreed with the 'concept of aggression' as the masters called it. I thought you had won your fame as the greatest killer of all time."

The marshal squeezed the stub of his weed and vapourised it. He tapped a grey panel and a robot appeared.

"The files on Son Takato at college," said the marshal. The files arrived in a few seconds and the robot bowed and withdrew.

"I shall ignore the main burden of the report from the college," said the military man. "I am interested in the

report furnished by the electronics master. It says here that you showed great aptitude in your studies, that you have a quick and original brain, and that you show an inventive turn of mind."

Son Takato nodded his head.

"Good. You will now become a Constructor. In that group you should be able to do some good. But I warn you, if I hear so much as a rumour of irresponsible conduct on your part, you shall die. You will leave for the Moon tomorrow. Now go to bed."

"Father, I cannot understand why you agree with my views . . ."

"I did not say that I agreed with your views. Your opinions, in any case, are worthless. You are little more than a child. I have my own reasons for tolerating you. Now go."

The marshal was left alone. He sat for a few moments without movement, his face

devoid of expression. Then he tapped the grey panel again.

"My lord?" asked the robot.

"Madame Takato. How long has she lived?"

"Four and two third absolute years, my lord," answered the robot.

"Have her destroyed," said the marshal.

"When, my lord?"

"At the second moon. And see that these files go to the Solar Records Centre."

The boy Takato slept fitfully in his narrow cubicle. The sweet air played upon his bland face and made the slender stalks of the pillars in the room sway gently. He did not wake until he found a breakfast tray floating before him.

"When am I to leave?" he asked the robot who had brought it.

"In forty-five minutes, Son Takato," the toneless voice replied.

"I wish to speak to

Madame Takato," said the boy. "Inform her."

"Madame Takato has been destroyed," said the robot, and left the cubicle.

Takato stared sightlessly before him. His face was grey as ash—and for the first and only time in his life, his hard, cold eyes were wet with tears.

THE SPACE craft which brought the boy Takato to the Moon landed on a three kilometre ramp blasted out of the contorted landscape. As soon as the cushion jets were killed, the ship was surrounded by a lively group of young Constructors.

Takato, riding down the twenty metre escalator from the cramped cabin, found himself staring down on a number of bobbing transparent breathing globes. In each globe a face looked up at him, and arms waved in greeting.

There were Terrist faces, lean, bony, and of pale, pastel hues; there were Venusian

faces, ebony and ivory; there were Martian faces, smooth in texture, faces that might have been fashioned from fine ceramics; and there were faces like Takato's own, faces typical of nothing but their owners' mixed ancestry.

The Constructors bore Takato on their shoulders as he reached the bottom of the escalator. He felt his body lifted like a feather. Thinking he had been mistaken for some returning hero, he tried to say: "I'm Takato. Takato from Mars." But the Constructors took no notice. They were obviously merry, despite their complete absence of noise.

The group arrived at a warm cupola where dancers, jugglers and musicians sported themselves in front of a largely heedless audience. Here there was sound again. In abundance. Takato was set down from his shoulder perch. He was almost buried in the jostling group of Constructors as they blundered about looking for rest plat-

forms and shouting greetings to their friends.

He found himself wedged between a red-bearded ebony giant and a dapper little Terrist with twinkling grey eyes. Both men removed their breathing globes and signalled to Takato to do likewise.

"What were you trying to say outside?" asked the Terrist.

"I said my name was Takato. I thought you might have mistaken me for someone else."

"Can't hear a thing out there," said the Terrist. "Not unless we were all on the same audio-circuit. Now in here you can make a jolly good row and have the satisfaction of hearing it. Tends to get a bit stuffy in here when the boys and girls let themselves go, but at least we do have air. My name," he added inconsequentially, "is Sorensen."

The red-bearded giant said in a thick, rumbling voice: "I'm Cha Tabarni, and I'm

from the Venusian black zone. Takato, eh? Any relation to the fellow who hawks fertilising gear round our twentieth parallel?"

Takato smiled. "Possibly, although I don't think I've ever heard my parents mention . . ." He caught his breath involuntarily, and shivered slightly. "I've never heard them mention any of our people working on Venus. But there must be three or four million Takatos in the system. It's a little difficult to get to know them all."

Sorensen laughed immoderately at Takato's joke, and the young man from Mars realised that one of his hosts had been drinking. Almost as the thought crossed his mind, a mug was thrust into his hands.

He choked as the fiery Venusian spirit landed inside him. His eyes spurted water and he felt his ears burn. Then, as he got acquainted with the idea of being five metres tall and in charge of

a team of plunging horses—a glorious feeling that sprang up in a millisecond—he heard the happy laughter of the Constructors burst like a wave about him.

After his third glass he loved them all. He embraced black and white and biscuit and olive, long and short and thin and fat. He rose and made a speech, a magnificent speech. Lunar gravity was kind to him when he fell.

The cupola, with its singers, dancers and jugglers, with its dank and steaming atmosphere, with its blur of grinning, bawling faces and its crowded vastness in which height was depth and breadth was length and every sound was brilliantly coloured, revolved about him with ever-increasing rapidity until the whirling, shrieking rainbow engulfed him in absolute darkness, silence and sleep.

He recovered consciousness with a pounding headache. But even as he felt the first of the pains throb across his skull from ear to ear, he

realised something with a fierce and sudden joy. He realised that here on the Moon he would find the means to usher in that new era of happiness which it was his destiny to bring to the sad and savage solar system.

TAKATO WAS happy on the Moon, as happy as any young man could be with so much hatred and anguish festering inside him. He had only to conjure up a mental picture of his mother to be engulfed in a wave of anger which almost throttled him. Yet, in a way, he was happy.

The Lunics were carefree and cosmopolitan. The Moon was populated with cheerful, active people from every inhabited planet, and with all the resultant cross-breeds. Here even a descendant of the Venusian satellites might work, if he were careful to forget his ancestry and traditions.

In their thousands of subterranean cells the Lunics made weapons of terror and

destruction for the Fighters. But they also manufactured communication equipment, space vehicles and components for the vast complex of electronically-controlled thought mechanisms. Here a young man like Takato could feel at home. In the Instruments Division or the Geodesy Section, in both of which Takato found employ, he could satisfy his desire to create rather than to destroy.

Time passed. Mercury looped round the Sun almost twenty-one times. The Mercurians reported that the last of the shattered satellites round Venus had erupted. They observed the sight with their usual impassive curiosity. Their report was acknowledged, filed somewhere on Earth, and forgotten.

Venus revolved round the Sun eight times and started on another circuit. The Venusians got fatter and blacker, or fatter and whiter, according to their zones. They exported so much sludgy rice

to the rest of the system that it gave them indigestion just to think about it.

The Earth wandered round the Sun five times. The Terrists inaugurated hundreds of new files, consulted thousands of viewing boxes, recorded millions of theses, and made innumerable pedantic jokes. They also yawned from time to time.

Time passed. But no word reached Son Takato from his father, the marshal.

"Takato," said Sho Sarvit, his superior in the Instruments Division, "you'll have to go to Earth for those records. I can't spare time to go myself, and if we leave it to those Terrists they'll ship us everything but what we need. Book the first available flight."

Takato was not sorry to get a break in routine.

"Come in," called Cha Tabarni, in answer to Takato's knock.

Takato entered the black giant's cluttered room. Speci-

mens of Tabarni's passion for artificial biology floated on platforms everywhere. The young Constructor had to be careful where he placed his breathing globe.

Tabarni appeared in the doorway. It looked like liquorice beneath its coating of cleansing fluid. His crimson beard was stringy and bedraggled.

"Why the big wash?" asked the small visitor, seating himself.

"Ah, old chum, you may well ask," rumbled Tabarni, towelling himself vigorously. "Hey there! Watch that phrenic alternator. I do declare, Takato, you're a clumsy one. As clumsy as the day you arrived. And did we get you tight that time! Laugh? Oh, Takato, it was killing . . ." He threw back his head and roared with mirth.

The words "Takato . . . it was killing; Takato . . . killing; Takato . . . killing" danced in the young man's brain.

"Something wrong?" asked Tabarni.

"No," replied Takato, "just thinking."

"Bad habit. Gave it up years ago. Incidentally, to what do I owe the honour of your company?"

"I'm off to Earth on the next flight. Sarvit wants me to get some met. records," Takato explained.

"Couldn't he just ask for them to be shipped in?" The Venusian fluffed out his beard and slipped on a magnificent green gown whose stiff folds glistened in fleeting iridescence.

"Sarvit doesn't trust the Terrist mind. Too woolly, he says. If you want something done, don't ask a Terrist. That's his motto. But what I came to ask you was this: Is there anything I can get you when I'm on Earth? Something to help in your work?"

"Very good of you, old chum," said the giant, lighting a fragrant weed, "but they've nothing there that could interest me."

Takato rose. "Well, I've asked you. By the way, what is all this special outfit for? Why the gorgeous robe, the perfumed beard?"

"I've been invited to Sorensen's farewell party in the big cupola. It's going to be quite a fling."

"I didn't know that Sorensen . . ." Takato hesitated. "I mean, he's quite young. Surely he's still useful?"

"Not in the opinion of his colleagues, old chum. Sorensen is all used up. He did some good work, but now he's making wrong deductions and fumbling the routine stuff. He had to agree it was time for him to be removed." Tabarni glanced down at Takato's face and saw the stricken expression.

He stared at Takato for some seconds. His poppy-red pupils glowed like live coals. He said: "I told you thinking was a bad habit, old chum. You can't be too careful about it. Takato, you need a break. You're tired.

Have a good time in those old Terrist museums and come back rested and refreshed. Takato, old chum, you can't be too careful."

TAKATO was beginning to get annoyed with the Terrist inspector who stood at the bottom of the space ship's escalator. Takato was getting soaked in the downpour. Rain popped off the inspector's cap and dripped from the end of his nose, but he continued making his laborious record of all the details connected with Takato's arrival on Earth.

"I've told you I represent the Instrument Division already," Takato protested. "Haven't you anything better to do than keep me standing here? Isn't movement on this planet sluggish enough without the authorities providing further delays? And in this rain, too."

"I'm only doing my duty, young man," growled the Terrist. "Now, you say you have certificates of vaccina-

tion against diphtheria, smallpox, tuberculosis, cancer and several psychological disorders? And an extra-Terrestrial transit certificate? I should like you to produce them, please. Thank you."

Takato fretted, shifting the burden of his body from one aching foot to the other. Then he realised that he was being addressed by an elderly man with a pointed beard. As he turned to give him his full attention, Takato was enveloped in the man's nimbus, for the Terrist wore a water-repelling cloak with created its own shimmering mist.

"Your name is Takato?" asked the elderly man.

"Yes. I have just arrived from the Moon. This man," the Constructor gestured brusquely towards the inspector, "has decided to devote the next few hours of both our lives to the examination of my credentials."

"Leave this to me," said the man with the beard. "I really should have sought you

out sooner. I'm from the Solar Records Centre and I have a little runabout waiting to transport you."

A few words from him to the inspector and Takato was released from the examination. As they climbed into the runabout's cabin, Takato's host said: "I just mentioned your father's name. I wonder you didn't think of it."

"One must be careful, you know," remarked Takato. "As he said, he was only doing his duty. You really can't be too careful."

"Why no, I don't suppose you can," said his companion with surprise. He looked slightly puzzled until Takato began asking the names of the places passing below them. The conversation became quick and friendly, and in a very short time they were landing at the Solar Records Centre.

They dined in a long, low refectory on insipid Terrist food. Takato's host was talkative and charming. Presently they rose from table.

"Now," said the Terrist, waving his hand towards a long corridor, "we shall go and see the index selector. You'll need to know how to work it before you can draw the records you need. But it doesn't take long to learn."

At the end of the corridor they came to a dull green console which bore many lines of dials and focussing meters. The Terrist drew his hand over some of the controls and the meters glowed and winked in response. Takato saw that the apparatus was easy to operate.

"In this section," his guide explained, "you will be able to locate your meteorological records. But don't get confused with the section on personal files."

Takato did not allow his interest to show on his face.

"There used to be a general ban on anyone but a member of the Central Council operating the selector," continued the Terrist. "It was feared that someone might

consult a personal file without permission. No one has bothered with the personal files for decades now. However, as you would say yourself, one cannot be too careful."

He left Takato alone at the control panel.

The Constructor touched some of the delicately-balanced keys gently and soon acquainted himself with the character of the console. Then he looked carefully about him to make sure that he was not observed.

Eagerly he leaned forward. The touch of his small fingers sent a flurry of colour along the row of meters and the needles on the dials danced impulsively. A photo-index strip shot out on to a tray. He picked it up and slipped it into a viewing box. A few turns of the side screw and he saw the images clearly.

He was looking at his own personal record.

Son Takato, born on planet Mars of Martian female Eon

Jarno and Terrist Colonel Takato at 1824 hours on Day Plus Eight in Abolute Year 336. Birth certificate, vaccination certificates, physical description, psychological analysis.

He clicked over the routine records until he came to the Sterile Belt college report. "Expression of heresies. Self-confessed peace-lover. Lack of respect for masters," he read slowly. His knowledge of Systematic Cyphers was not good. He had a little difficulty in translating the strange phonetic groups.

"Great aptitude in studies. Quick and original brain. Inventive turn of mind." He smiled and looked at the image of Hunt's florid, good-natured, worried face.

There was little more. A deposition from his father, submitted to the Central Council. It was, in fact, a special intercession for his life. It bore the Council's counter-stamp. Thought Guardian's report on his Lunar activities. "Drinks

little. Sociable. Excellent work done in Instruments Division." There was no image of the Thought Guardian's face.

Takato shrugged, and gave the box a final click. What he saw made him draw in his breath swiftly.

It was the image of a scrap of paper no larger than an apple slice with a brown rind. Three faintly-scrawled sentences appeared on it:

"Takato will make his son powerful. But every man must hand on life, not death. Therefore Takato's son will destroy his father's works of death."

That was all. He sat looking at the image for some minutes, his lips parted in excitement. He did not know where this scrap of paper had come from, but he understood its significance. This was the sign for which he had been waiting.

TABARNI LOOKED around as Takato entered his room.

"Wait a moment and I'll be with you. Did you have a good trip?" he asked. He plugged in the last of his sensory terminals and joined Takato on a rest platform.

"Yes, a fairly good trip," said Takato. "But those Terrists got in my hair a bit with their everlasting records. And the gravity! It beats me how they manage to move at all."

"The answer is that they don't if they can help it," remarked the Venusian. "How did you find the food?"

"I wonder someone hasn't taught them how to cook! But look, I didn't come here just to talk about Earth. I was wondering if you would lend me your casualty nomographs, Cha." He indicated an untidy pile of papers.

"Of course. Something new that Sarvit's cooking up?"

"No, it's a little scheme of my own. Have you ever lived in the Sterile Belt, Cha?"

The Venusian stretched luxuriously. "Thank you,

no. I'm all for the pleasures of civilisation and room enough to indulge in them. Why? Are you going to bring more life to the Belt?"

"Yes and no. I'd like to pave the way for more life, though. You know about the radio-active atmosphere which surrounds the barren planets in the belt, of course."

The giant nodded, and his small companion began to dilate on his theory.

"They have to bore a channel in the atmosphere round the surface of every planet," he said. "It's rather like the hole that a worm might drill round the surface of a sphere buried under a metre or so of soil. Only in this channel, which has been carved out of the atmosphere by neutralising gear, is any life possible. Consequently they have to save every available bit of space. And that is why they use the Alpha-Beta frequency translation."

"I hear they have to do all their building and carry on

all their activities in that cramped tunnel," said Tabarni. "And the Alpha-Beta dodge is to enable them to build two things in the space of one. Right?"

"That's it. It costs so much to bore the channel that they can't afford to build more than one storey high. And the upkeep of the channel is enormous. The radio-activity is always leaking through the ceiling. The Alpha-Beta frequency translation is quite simple in principle. You construct buildings in two frequencies. Two superimposed storeys take up the same space. You build one in Alpha and one in Beta. They are co-existent in absolute space and time, but they're relatively distinct from each other because of the different molecular frequencies of their structures. Take the workers, for example. They sleep in Beta hostels and arrive at their work in co-existent Alpha factories by concentrating on Alpha thoughts."

Cha Tabarni tugged his

beard and stifled a yawn. "Well, it's simple enough, if a little inconvenient."

"A little inconvenient!" exclaimed Takato. "It's downright dangerous. Before a man translates himself he has to stand in a clear Beta space so as to arrive in the corresponding Alpha space. Just think what happens when some office furniture has been pushed carelessly into his Alpha space. Some of the injuries that occur when people translate themselves into the middle of tables and chairs are not very pretty. I even heard of one poor devil who translated himself into the middle of a meat-slicing machine."

Tabarni chuckled. "It was the last time he did that, I'm sure."

Takato was slightly offended. "Don't laugh, Cha. You might have to live there some day. The problem has always been, how to get over these difficulties."

"Oh, I should think that would be fairly simple," said

Tabarni. "You just bolt down everything in sight, from lathes to viewing boxes."

Takato shook his head. "Too complicated. No, what they've done is to define the translation stations as narrowly as possible. Usually Beta stations are beside beds, so that men can go straight to their work-benches. But no one can be made to spend the whole day in one place. You can guess what happens when someone strays too far away from his workplace and someone else suddenly translates himself into the same space. The results are terrible."

"So what do we do?" asked Tabarni. His gaze wandered round the room. Plainly he was bored.

"I think the Alpha-Beta translation is a failure. It should be done away with."

"Yes, let's do that. Now that you've got that off your chest, can I offer you something to eat?" He rose and started to prepare a tray.

"Listen, Cha. There would be no need for the translation if the ceiling in the radio-active atmosphere could be raised. I've got an idea for a neutraliser which might clear the atmosphere for countless thousands of metres above the surface of a planet. Look, I've done some sketches on the back of the notes I made for Sarvit when I was on Earth."

Tabarni poured a couple of drinks and set a tray of nourishment floating before Takato. He munched the Venusian rice paste as he studied the sketches.

"Mm. Yes, I think you've got something here. It looks as if . . . Hello! What's this?"

Takato glanced at the paper Cha was studying. He blanched. "Let me have that," he said quickly.

"Of course," murmured Tabarni, very softly. "Of course, my friend. This is not the sort of thing one usually writes on the back of one's notes. You really can't be too careful about these things,

Takato. I think I've told you that already."

Takato snatched the paper from the Venusian's hand. It bore the transcription of the three sentences he had read in the Solar Records Centre. "Takato will make his son powerful. But every man . . ." He found Tabarni's fiery eyes burning into his own.

"Well?" he asked, tensing himself for what was to come.

Cha Tabarni allowed Takato's sketches to float to the floor before he answered.

"Son Takato," he said quietly, "you present me with quite a problem."

"Why?"

"Because, Son Takato, I am the Thought Guardian assigned to you during your days on the Moon."

Tabarni towered above Takato. He wagged his hand weapon warningly. "Just sit still," he said.

The small man eased himself back on the rest platform, but his body had a latent tenseness. Tabarni knew he would spring at any moment.

Deliberately the giant engaged the young man's eyes. Reluctantly Takato answered his gaze, and found himself lost in Tabarni's glowing red pupils. It was like being swallowed up in twin furnaces.

Takato found himself losing consciousness of his own being, of the passage of time, of the very existence of the room in which he sat, of everything but the red haze which enveloped him.

Then, suddenly, everything snapped back into focus. There was Cha Tabarni standing in front of him, swinging the hand weapon from the tip of one finger and smiling at him.

"Now let us have a little talk," said the Venusian.

"If you wish," replied Takato, who was no longer alarmed. "But why not destroy me now and make an end of it?"

"Because I am your friend."

Takato smiled sourly. "An old trap," he said.

"Perhaps I can convince you," continued the black giant, leaning forward intently. "I wrote the report which you saw at the Records Centre, the report of your activities on the Moon. I said you drank little. That is true in the main, if one chooses to overlook the occasion on which you got roaring drunk . . ."

"Which was your doing?"

Tabarni nodded. "Exactly. A being intoxicated in strange surroundings often reveals matters which would otherwise be hidden. You got drunk in a surprisingly short time. And since then, I notice, you have been careful never to give yourself away again in the same manner."

"Give myself away? I don't understand." Takato stirred uneasily. Tabarni tapped him on the knee.

"Perhaps you don't remember what you said . . . I tell you, Takato, it was one of the most magnificent democratic speeches it has ever been my privilege to hear."

Takato stared at the Thought Guardian, surprised and fascinated.

"You damned your illustrious father from here to the outer nebulae. You tore apart in words which were almost luminous the whole concept of aggression, terror and annihilation. If ever a man earned death in agony, you did that evening. And your mother's name occurred again and again."

The young Constructor's body went limp. "I see," he said dully. Then he raised his head again. "And do I have to thank you for my life?"

"Yes, you do. I persuaded your drinking companions that you were being slightly bawdy. The girls were blushing and laughing at the same time. The rest of us roared with laughter, and I laughed loudest of all. And then, of course, I saw that the incident never found its way into your records."

"But why did you do all this for me, Cha? Why?"

"Because, my impulsive, honest, idealistic and arrogant friend, I have work for you. What has blurted from your lips is what I have hidden in my heart for years without number. You and I are going to lead a great rebellion against the vicious ideas which poison every planet in the solar system."

"I don't understand." Takato passed a hand quickly before his eyes. "I cannot understand. If you share my ideas, then how could you have stood aside when Sorensen was destroyed? You did not save him. Yet you saved me. Why, Cha, why did you allow Sorensen to be eliminated?"

Tabarni dropped his eyes for the first time. He shifted his feet uneasily. "I have to live with my conscience," he said. "You don't. Takato, how old do you think I am?"

"Three absolute years?"

Tabarni smiled. "You'll never guess. I have lived for nearly twenty-seven absolute

years, roughly two hundred Terrestrial years. That surprises you? I don't wonder. Perhaps you didn't think that people live to such ages. They don't, of course, if they allow themselves to be destroyed. But Venusians naturally live to great ages. I was four absolute years old when I disappeared the first time. Since then I have cheated the system time and time again. Oh, it's a nerve-jangling process, this continual disappearance and re-appearance under a different name, and with a different occupation. You learn much about solar beings, of their strengths and weaknesses. You watch them as they are tricked, terrorised and finally destroyed. And you do nothing, nothing to save them, because you must save yourself. Takato, I have waited for the greater part of three absolute decades to meet a man such as you. And now that I have found you, we can plot this revolution together. But I warn you, time is short. Time is pitifully short."

Takato had lost his bewilderment. His eyes had taken on a calculating expression.

"Agreed, Cha," he said, "but surely this is a poor way of plotting. Why, anyone might overhear our conversation."

Tabarni smiled. "Impossible. At this moment we do not actually exist. You and I are in a trance which I induced. For us time has stood still. No matter how much we talk nor how far we travel, we will find, when I release us both, that no time has passed and we have not moved a millimetre."

"Ingenious, Cha. Now I'll tell you what I have been hoping to do. In the first place, I must help to fulfil the first part of that prophecy. I must become powerful—like my father. Only by becoming powerful can I put myself in a position to challenge and overthrow the system. Now what could make me more powerful than to bring life to the barren

planets of the Sterile Belt? If my neutraliser works I shall be one of the most important men in the whole system. And I shall then be free to organise the destruction of my father's works of death."

The Venusian nodded soberly. "I thought that must have been at the back of your mind. Only by replacing one great Takato by another can the revolution succeed. The greatest killer is a Takato. In the new era in which there will be no more destruction or violence, the greatest heretic must be a Takato. It's inevitable."

"That seems to make you sad," remarked Takato.

Tabarni laid his hands on the young Constructor's shoulders. "Forgive me," he said, and his great rumbling voice seemed to have sunk to little more than a whisper, "forgive an old Venusian. Perhaps I have lived too long, seen too much. Remember only this: time is short, pitifully, terribly short."

The red haze burned about Takato. All sense of direction, time and existence was lost. Then he felt himself released. He was back in Tabarni's room and the big Venusian was munching rice paste and studying his sketches of the neutraliser.

"Mm. Yes, I think you've got something here," he was saying. "It looks as if you might just have time enough to finish it."

TAKATO HAD some trouble with an inspector from the Central Council's Technical Board. The dour Lunic refused to believe that the young man's pilot model justified its estimated expense. Only when Takato mentioned his father's name did the inspector promise to put the neutraliser project before the Board.

The Board's decision arrived some days later. Its few clipped phrases were embossed on a record strip which bore the Council's Top Level seal:

"Son Takato released from Instruments Division. To proceed with neutraliser project. Use can be made of all available materials, within sanction of Lunar Council. Test model to be completed as soon as possible." The signature was that of Marshal Takato.

"Well, how are we getting on?" Cha Tabarni asked one day when he came to visit Takato at the pilot plant.

Takato's face was tired and bathed in sweat. He pointed from the odalisium gallery on which they stood to the pole-like structure of the neutralising gear. It stood some seven metres high, and was already festooned with cables.

"That's the heart of the thing, or, if you like, the spine," said Takato. "We've only just started on the rectifiers and the soleno tubes won't be ready for weeks. When she's finished she'll occupy all this floor space and a bit more besides."

"Bit clumsy, isn't it?" asked Cha.

"It's only the pilot. The prototype will be a lot sleeker. I haven't been able to organise the jigs yet. There isn't a lot of repetition in this section, but I'll have to put the robots on to templates in a couple of days."

And so the work proceeded. Takato became more and more haggard. Over him hung the prospect of failure. All about him lay its agents: tools which were defective, robots which burned out in the middle of skilled jobs, materials whose properties he had to take on trust.

When the pilot model was complete, it was tested. Research Centre provided a stratum of radio-activity. The pilot neutraliser made a magnificent dent in the stratum in five milliseconds. The concavity remained unchanged in volume for almost one-twentieth of an absolute year afterwards. But, in the process, the neutraliser melted to scrap in a startling blue glare.

Young Constructors, who had come to see the show,

slapped Takato ironically on the back, and returned to their work. He had proved the principle, that was all.

Marshal Takato's personal recommendation was needed to persuade the Technical Board to invest in another pilot model. The second pilot was a success. It bore its load well, dispersed the stratum entirely, and produced valuable data on its own component materials. The way was open for the prototype.

When the day came for the first full-scale test of the prototype, Takato stood with a group of other beings on the limpet platform which had been stabbed into the surface of the barren planet, Steroid 32279. He stared at the huge, simple body of the neutraliser anchored above the sharply-curving horizon of the tiny steroid. Then he became aware that the sight-pane of his head globe was blurring over. Cold fumes from the artificial atmosphere in the narrow habitable channel were patterning the pane with

a crazy grid of white lines. He brushed the clearance toggle and wished, momentarily, that Cha Tabarni had come with him.

"Fifteen seconds to go," said the inspector's voice in the audio-circuit. All eyes were fixed on the twenty tall antennæ which projected from the top of the neutraliser like a crown. They flickered blue and gold in the wisps of radio-activity which leaked through the roof of the cleared channel.

The robot with the recording apparatus checked the lenses for the last time and then stood motionless beside the purring mechanism. The Venusian representative of the Technical Board brushed the clearance toggle of his head globe as his sight-pane frosted over. Everyone else was still.

Then it happened.

A wave of blue fire sprang from the neutraliser and disappeared an instant later. So quickly had this single pulse

of dawn come and gone that it was difficult to realise that anything had occurred. The neutraliser swung softly on its anchor cables, its antennæ untroubled by dancing sparks. The scene appeared unchanged.

"Congratulations," said the inspector. The robot clicked off its recorder. The Venusian thumped Takato on the back. Through his audio-circuit the young Constructor heard a gabble of comment from the other members of the party.

"Takato has done it . . . Excellent device . . . Brain like his father's . . . Bravo, Takato . . . Yes, it should hold . . . Something historic . . . the Board will be delighted . . . Life possible here . . . Check the instruments carefully . . ."

It was too good to be true. This was success indeed. For a moment Takato forgot his tiredness, his aching eyes, his secret doubts and despairs. All he could hear in his own mind were the words: "I am

Takato. I am Takato." For a moment he even forgot the revolution.

THE ROBOT looked up from the desk. "Yes?" it asked in a coldly formal voice.

Cha Tabarni stopped, bowed with ironic courtesy, and asked respectfully: "Is Director Takato free? I should like to see him for a few moments, if you please."

The robot flicked on the tele-speaker. "A Venusian person to see you, Director," it said. It looked up and asked: "Your name?"

"Cha. Tabarni."

"The person is called Cha Tabarni," reported the robot. "The Director can spare you a few minutes. Enter by that door."

"I'm very busy, Tabarni," said Takato as Cha entered his office. "What can I do for you?"

"Look into my eyes," said Cha.

Takato looked reluctantly. The red haze enveloped them both. When the room had

snapped back into focus, Takato showed his annoyance.

"Really," he protested, "there is no further need for this nonsense. No one is likely to overhear what we say. And if they did, what of it? I am now chief technical director. I am above suspicion. I am absolutely secure."

"How is the activity clearance going, Director?" asked the Venusian, pulling at his beard.

"I've got fifteen crews working in the Takato Belt at the moment, and another three are due there next week. But you didn't come here to discuss that. Have you anything material to report on the revolutionary plot?" He stole a glance at his mini-chronometer, before he realised with an irritated shrug that time was standing still.

"You appreciate what failure would mean?" Tabarni tossed the question back with apparent irrelevance.

"Yes, yes. Go on with your report."

"It is a good thing, Director, to remember from time to time just what we are undertaking."

Takato leaned forward on his desk. "Listen, Tabarni, I've noticed lately that your attitude has become more and more suspicious. I suppose you think I have forgotten the revolution entirely in the midst of the honours that have been showered upon me. Well, you're wrong. I am powerful, but I intend to use that power in the only possible way, to forward the revolution. If we are to work together we must trust each other. Do I make myself quite clear?"

"Admirably clear," replied Tabarni calmly. "As to my report, you know I have been visiting Venus frequently in the past few months. Ostensibly I have been engaged on oryzan research. In reality I have been renewing contacts among the senior technicians

who I know to be sympathetic."

"Why should the senior technicians on Venus be sympathetic?" asked Takato.

"Because they are powerful men in their way."

"And so?"

"And so they have much more to lose than their subordinates. To them the revolution will be a conserving force, establishing them in the positions they have won under the present system. Those who oppose a successful revolution stand to lose both ways. The present leaders of the system can dispense with them at any moment, and once those leaders are defeated the revolutionaries most surely will."

The Director fingered his chin lightly and stared at Tabarni with his cold enigmatic eyes. "Go on," he said.

"It is safe to say that we have on our side beings who control the surface transport system, beings who control the storage of the Venusian

products and—most important of all—beings who can disrupt the very sources of supply. Remember, it needs only one switch to be pulled in a zonal power assembly to halt every robot working in every paddy field or plantation throughout a hemisphere." Tabarni permitted himself a smile. "One of the dangers of centralisation," he observed.

"Go on," said Takato.

"Imagine every field robot stopped in its tracks. Imagine every truck sliding to a halt. Imagine the silos locked. Imagine the Agricultural and Supply Council hesitating—for we have sympathisers even on the Council. The system, with only three days' nourishment in store, will be at the mercy of Venus. The system will be absolutely at our mercy."

"Imagine," said Takato quietly, "a Fighting armada making full speed to Venus, its members living on emergency rations. Imagine that

armada forcing a landing on your planet, gaining control of the silos, of the power assemblies, of the plantations once again. What then?"

Tabarni hesitated. He tugged at his beard, crossed and uncrossed his long legs on the chair which he dwarfed, and said nothing.

"You see?" smiled Takato. "One of the dangers of de-volution or specialisation," he said with a hint of irony in his voice, "is that Venus has most of the system's food but none of the system's arms. In the short run atomisers and space armadas can beat the threat of starvation. And it is through the short run that the revolution will have to survive if it is to reap the benefits of the more distant future."

"What do you suggest?"

"Have you thought of the uses of the Takato neutraliser? If it can clear a great volume of radio-activity, which is a pretty formless thing to tackle, think what it can do to the nuclear drive

of a space vehicle. What good is an armada when its motive power—and its weapons—are crippled before it can get within striking distance of a planet? Now, Tabarni, you see the full beauty of my plan. I have given the system a two-edged weapon."

The Venusian slapped his knee hard, threw back his head and laughed. Then he sobered and asked seriously: "How do we set up neutralisers on Venus without attracting the attention of the Fighters?"

"Perhaps you don't know it, but the rice blight on Venus is caused by radio-activity . . ."

"I know no such thing! The blight has nothing whatever to do with radio-activity."

"Tabarni, you disappoint me. You came here today to discuss that very question."

"Did I?" asked Tabarni. His eyes mirrored dawning comprehension.

"Why else? And you urged me to divert a substantial

number of neutralisers from the Takato Belt to Venus to help arrest this blight."

Tabarni started laughing again. "Takato—er—Director," he rumbled. "You mean to turn these life-giving devices to destructive purposes. Truly you are your father's son. Your scheme is brilliant."

"Destructive? Call them defensive, rather. I'm glad you approve the scheme. Now, Tabarni, if there is nothing more to discuss . . . I'm rather busy. I should like you to leave again for Venus immediately. You will want to be on the spot when the neutralisers arrive."

Tabarni rose and silently produced his crimson emanation which wrapped them both in insensitivity for a few moments. The red haze disappeared, the office resumed its normal dimensions and Tabarni walked silently through the doorway.

FIGHTING HEADQUARTERS were usually very quiet, working

with the silent efficiency of a machine. Now they buzzed with activity. In the central operations room Marshal Takato paced to and fro, his eyes narrowed, his lips drawn back from his teeth in a snarl.

In his hand he held a transcript of the message which a monitor, orbiting one of the Martian moons, had intercepted earlier in the day. It came from some body of upstarts describing themselves as the Venusian Revolutionary Council, and it was signed by someone called Cha Tabarni. The marshal read it again:

"Violence and terror have been abolished on Venus," the manifesto began.

"Easy," sneered the marshal. "There never was much violence or terror in that steaming swamp of pot-bellied farmers."

"The Venusian Revolutionary Council is determined to bring about a state of liberty and tranquillity in the whole system. Solar

beings, unite with us. Help us to bring dignity and regard for life back to the system."

A powerful Venusian transmitter had been spewing out this defiance for many hours, repeating the same words continuously. The marshal had sent out a general alert and had summoned a staff conference. Now he paced the floor of the central operations room impatiently, waiting for his officers to arrive, and watching the robots quickly arrange the planetary and systematic charts and set up the tri-dimensional projectors.

The officers arrived. Their shaven heads bobbed in the cloisters and around the chart tables. A tide of alarmed conversation made the delicate pillars quiver.

"Silence," shouted Marshal Takato. "Fighters, we have come together to consider action. As you know, a revolutionary appeal has been issued by some demented

schemers on Venus. You will agree that this madness must be crushed at birth. I will call upon . . . Yes, what is it?"

"Report on Cha Tabarni from the Solar Records Centre, sir," said a colonel. "It appears that Tabarni was Thought Guardian to your son on the Moon."

The marshal's indrawn breath made a sharp hiss, but in a second an order from him had stilled the murmur that rose from his staff officers.

"I will call upon Major Vataron to speak," he said.

The major, a tall Martian with a pale face, spoke rapidly: "Since the first message was monitored a constant stream of repetition has been coming in. But there has been one variation on the manifesto. It is in the form of an ultimatum. All Fighters must surrender their weapons and space vehicles or face starvation. The system will no longer be supplied with food. This siege will last until

the Fighters surrender." He resumed his seat amidst startled silence.

"Such an ultimatum makes immediate action imperative," said Marshal Takato. "Look at the chart to your right. You will see from it that we can reach Venus on full final-stage power, making use of boosters, within the next week. The curve will be uneconomic, but speed is the first consideration. Our only problem is that of supplies. We must assume that our mission on Venus will be successful, for we shall not be able to return to Mars immediately. We would have neither enough food nor enough fuel. Fuel we should be able to obtain from the Moon if necessary. It is not likely that the Venusian rebels have supporters on any other planet. But unless we can actually regain control of Venus, we shall starve. Any questions so far?"

A tense-looking young logistician rose: "Marshal, I presume you will not commit

all the Fighting resources at once. I suppose you will hold some space craft and weapons in reserve here."

Takato answered briskly: "The maximum strike will be mounted. Everything, every Fighter, every available space ship, will be put into this operation . . ."

"But sir . . ." protested the logistician.

"Silence," said Takato. "You, as a logistician, should appreciate that no other threat could possibly compare with this Venusian siege. Above all we must have nourishment. If this mission fails for lack of impetus we shall be worse off than we are now. We shall have squandered our Fighting resources to no end. No, one magnificent strike must settle this business once for all."

There was a bustle about Major Vataron as two messengers brought him transcripts. His face turned sickly grey as he read them. "With your permission, sir . . ." he said. The marshal nodded.

"It has been reported from at least three separate stations that Director Takato has declared his support for the Venusian Revolutionary Council," said the major, getting out the words with difficulty. "I'm extremely sorry, sir, but there doesn't seem to be much doubt about the authenticity of the transmission. It couldn't possibly have come from a Venusian transmitter."

The operations room held a vault-like silence. The marshal was aware of scores of eyes directed on him. He squared his slightly-bowed shoulders and said: "This confirms the wisdom of my decision. The future of the system depends on one sudden, mighty, paralysing blow. If we had more time we could have subdued the Moon first and punished his—the Lunics' defection. But time is terribly short. We shall attack Venus first. Then, when we have secured our food supplies, we shall deal with the Moon. If there are no other questions . . ."

EVEN TABARNI had to admit that it was a magnificent sight. He looked into the eyepiece of the strato-scanner and picked out on the calibrated screen the long line of Martian assault craft.

"Look," he invited Luronne, the woman Constructor who stood at his elbow in the Venusian observatory.

Together they saw the armada strung out in orderly formation, as if for review. But the ships were so disposed that a surprise attack from any angle would not have found them unprepared.

Tabarni turned the focusing thread and took in part of the fleet in greater detail. The craft varied in shape according to their function. The marshal's flag-ship bore no distinguishing marks—a wise precaution. The small control binaries rocked gently like dumb-bells about their gravity centres. The bulbous supply ships rotated quickly about their axes at intervals all along the three hundred

kilometre base-line of the fleet. Pencil-slim scout craft circled the boundaries of the vast Fighting formation or bobbed at the rear of their mother ships. The ovoid battleships, with their deflectors and atomisers smoothly shrouded, poised motionless, deadly and beautiful. Each had its mass inertia axis aligned with a Venusian radius.

"It can't be long now," said Luronne. She gave a little shiver. Both rebels glanced at their minichronometers. "Any luck with those Martian inter-ship signals?" she asked.

"No," said Tabarni. "They're coded and scrambled. No chance of knowing what they plan. Still, there's only one thing they can do. If we won't go up to meet them, they'll have to come down to us."

"THERE'S ONLY ONE thing we can do," said Marshal Takato. "If they won't come up to meet us, we'll have to

go down to them." He looked at the faces about him in the control room of the binary flag-ship.

"Can't we use long-range action, sir?" asked a captain.

"Little point in it," answered the marshal, tapping his fingers on a pilot's chart of the Venusian approaches. "Doing some damage at a distance wouldn't get us any nearer the food, and that's what we want. We're already on short rations. Remember, the Venusians can afford to wait; we can't. No, we must go down there and land. The scouts can let off their offensive weapons as they approach. That should make the rebels keep their heads down. If they send up any craft at the last moment, we can knock them out of the sky."

Major Vataron said: "The thing that worries me, sir, is the silence. They must know they are helpless against us, yet they don't even bother to

open surrender negotiations. I had expected at least an offer to parley."

The marshal laughed. "Silence is the oldest weapon in the armoury of psychological warfare," he said. "Silence and noise. Thinking beings feel uncomfortable in these extremes. No, the Venusian silence is not to be feared. They have nothing else to offer but their silence, the sullen silence of a child which has misbehaved and can challenge its parents in no other way. This was an ill-considered rebellion, rashly undertaken and imperfectly planned. The trouble with most rebels is that they forget it is not enough to have one strong card in their pack."

He bent to the charts on the table and began to issue directions for the attack. Every section commander checked his minichronometer.

When his subordinates had gone, the marshal was left sitting in the narrow bucket-

seat in the Plus spheroid of his binary. He commanded a view of the circular corridor which connected the Plus to the Minus spheroid. Only the clicking of the plano-indicator above his head reflected the dip and sway of the craft. Food was placed before him, but the emergency rations were unappetising and he pushed them away. A medical robot recorded his pulse, respiration and temperature, and asked him if he felt well. It withdrew after he had snapped a reply.

He looked up as a colonel struggled up the corridor against the gyro-field. "All sections report themselves ready, sir," he said.

"Very well. The operation will begin as arranged when I give the signal."

There was silence in the control room of the Plus spheroid. Both men's eyes were fixed on the succession of jagged blips which passed across the screen of the telechronometer.

"Now," breathed Takato, and jabbed the signal button.

Through his audio-circuit he heard the thunderous blast of the first eighty scout craft as they flung themselves down, down, down, into the bland fog of Venus.

"Now?" asked Luronne, jerking her eye away from the strato-scanner.

"Wait," Tabarni commanded. The eye-piece of the scanner glowed red as he concentrated on the images. "Twenty. Forty. Fifty. No, surely not! Seventy. Seventy-plus. Seventy-plus scout craft coming down in attacking formation. Altitude, forty thousand. Minus. Minus. Minus. Now — thirty thousand. Minus. Minus. Minus. Slow orbit. Range fifteen steady. Wait for it. Wait for it. Now!"

"What?"

"Now," shouted Tabarni. "*Now. Now. Release now!*"

Constructor Luronne jabbed the release button.

MARSHAL TAKATO bent forward intently, listening to the receiver on open circuit.

"What's that jabber?" he asked.

"Venusian control," said the colonel. "Cutting in on the scout transmission."

"Channel them off," the marshal ordered. He brushed the volume panel and the scout commander's voice boomed in his ear.

"Acceleration eight point four," the voice intoned. "Second bearing. Radial deviation four four three. Hold it. Hold it. Blue Leader, hold it I say. Second velocity. Six-four to six-five by ten to minus eight. Hold six-five. Keep station Green Wing. Third bearing. Level off. Steady orbit. Slow orbit. Weapons alert. Stand by all crews. Wait for it. Range averaged at fourteen nine. Wait for it. Wait for it. Fourth bearing. Radial deviation six two . . ." The receiver crackled. Takato thumped the panel.

"Radial deviation six two nine. Six two . . ." The receiver emitted a high whine.

"What's wrong now?" demanded Takato. He bore on the volume panel with all his might.

"Fighting Base!" the scout commander's voice whispered in the receiver. "Fighting Base! Our motors . . . our motors . . ."

Then there was silence.

The marshal parted his lips to ask a question when the sudden golden flash at the astrodome answered him. The control binary rocked for a moment. The flash faded quickly and was replaced by a harsh blue glare. Finally there came a tender green effulgence. It dwindled in its turn and the astrodome became a blind eye once again. The whole display took only a few seconds.

The colonel cleared his throat. "The weapons must have detonated while the craft were still within range, sir," he suggested.

The marshal shook his head. "I don't think so. It didn't sound as if they had even released the weapons."

The colonel screwed the probe on his scanner to the fullest extent while the marshal kept pressing the panel on the receiver. The colonel concentrated. Then he shook his head.

"Can't really see anything, sir," he reported. "Nothing down there but billowing clouds of fission products. It must have been pre-detonation of the weapons."

The marshal stared straight before him, quite silent. At last the colonel asked: "What now, sir?"

THE TENSION which had been building up in the Venusian observatory had suddenly given way to the limpness of relief. And the relief was quickly followed by a thrill of pleasure. The black giant with the flaming beard was delighted. He slapped the slight shoulders of the woman beside him and chuckled.

"Well, who'd have thought it!" he exclaimed in a voice that was almost happy. "I thought the fleet would be disorganised when we turned the neutralisers on. I expected their motors to stop. I expected to see all those scout craft flutter to earth like leaves. But the last thing I expected was that they should disintegrate. We must have detonated the weapons in some way before they were released. Bang! Up goes the whole assembly."

But there was an undertone to his voice which gave his exultation the lie. He knew the battle was not yet won. Luronne echoed his mood.

"Beings have just been killed," she said dully, pushing a damp lock of hair from her brow. She turned away from the scanner.

Tabarni shrugged. "Fortunes of war, old friend," he said. "We're lucky to be alive ourselves." He looked at the bulletin board which had been hastily rigged in the

observatory. The neutraliser bases were reporting the success of the first release. Two noted faulty connections which had almost given way under full loading. One neutraliser had been crippled completely by an overload and its robots had been disintegrated.

Through the broad window of the observation dome Tabarni and Luronne could see only the shifting curtain of impenetrable mist which covered the lush vegetation. Through the strato-scanner they could see nothing. The eruption of the attacking scout squadron had distorted all the activity fields within the scanner's range so that the instrument was useless.

Tabarni pulled at his beard. "This is a new problem," he said. "Thanks to the success of our first blow we are virtually blind. No way of telling now where the marshal intends to attack next. We shall have to keep the neutralisers running on a low power datum continuously, and jerk

the amplitude up to a maximum every so often. That way, we may be able to strike what the marshal is sending against us before any weapons hit the planet.”

Almost a day passed. The drifting clouds of radio-activity and neutralised gases thinned out in the region of the observatory, but true vision was still impossible. The advantage of movement lay with the marshal. The Venusians still had the advantage of time. They could still afford to wait.

The first images and transcripts began to pour from the recorders. They told of the havoc wrought in the White Zone, on the other side of the planet. Several powerful weapons had landed. Twenty Venusian city-states had disappeared. Forty more had been scorched, semi-liquified or demented by radiation blast. Millions of people in the closely-packed area were dying slowly, their cellular structure disintegrating by the hour.

Tabarni picked up his hand calculator. The reflected pin-heads of shuttling light passed like coloured ripples over his face as he worked. The calculation was soon done.

“If the details in the recorder are right,” he said slowly, “then only three weapons could have struck the planet. Only three got through. But each battleship carries at least ten such weapons. Which would seem to show, at first sight, that only one ship was used for this attack, and that even then not all its weapons got through the neutraliser barrage.”

“That means something?” asked Luronne, looking up.

“Possibly. The damage which could be done by three weapons is about the same as the damage actually done in the White Zone. That’s all the little calculator can tell us. But do you think it likely that the marshal would attack the White Zone with three weapons, or even with a single ship carrying ten weapons?”

Tabarni shook his head and flipped the calculator in his hand.

"Can you imagine the marshal sending down one ship to bombard a hemisphere? No, that's not the way his mind works. Big decisions, big kills, big havoc—and big mistakes. That's the Takato technique. No, Luronne, I think we can safely assume that a great many battleships were lost in that attack. I think, Luronne, that the marshal has lost most of his armada."

THE STAFF officers—those that were left—had gathered in Marshal Takato's control binary. They were all haggard. Some were unshaven. One or two looked sullen.

The marshal sat, almost in a crouching position, behind the table which was covered with a tangle of charts. The little man seemed to have shrunk further into his uniform. He was very tired.

Marshal Takato, supreme

killer of the solar system, looked up. "There is little need to tell you what you already know," he said, surveying the officers with a sour eye. "Our mission to Venus has failed. We have brought death, terror and suffering to part of the planet, but we have lost all our fleet except the supply ships and the control binaries."

He paused for a moment, as if he felt the need to gather strength before going on. In the control room only the click of the plano-indicator broke the silence.

"You know how it has been done, I think. I did not appreciate in time the possibilities of the Takato neutraliser." He repeated the phrase "Takato neutraliser" dryly. But he did not smile, even in irony. "My son," he continued, "is nothing if not ingenious. We have no further business here, Fighters. There is only one place to which a visit is necessary. The Moon."

"Has anyone else anything to say?" asked the little man

in the drab uniform. No one answered.

"I am going to the Moon," said the marshal, "to visit my son, and to take him with me on a little journey. A little journey to wherever beings go when they have no longer any use for life."

DIRECTOR TAKATO was uneasy. He stood in front of a glowing screen which warmed him pleasantly. He balanced in his hand a glass of Venusian spirit which tasted good. He smoothed out the skirt of his elegant blue lounge gown which fitted him like a caress. Yet the transcripts in his hand made him feel uneasy.

He glanced at the one which the monitors had produced first. "Venus Revolution transmitting," it said. "No contact with Martian forces for two days. Havoc in White Zone being brought under control by medical and construction teams. No further weapons have landed."

The next message read :

"Venus Revolution transmitting. Scanning shows Martian forces have left Venus approaches. Nothing to be seen at high altitude but discarded equipment."

The third message read : "Venus Revolution transmitting. Confirm departure Martian forces. Provisional curve indicates destination Moon."

The Director tossed his glass of spirit into a canister and began to stride up and down the lounge. He looked up sharply as a robot entered.

"Mercuric observations, my lord," it reported. "Tentative figures only. Curve of Martian flight appears to be towards Moon."

Takato took the sheet of figures from the robot and studied it. Then, with head bowed in thought, he left the lounge and walked along a subterranean passage to the operations cupola. He barely glanced at the group of Constructors who were stationed at various instruments under

the transparent plastilux dome. He stopped in front of a systematic chart and began to operate a hand calculator.

"Record this," he said to a robot. "Estimated time of arrival of Fighters, zero five nine hours. And you'd better add a plus or minus half hour tolerance. Get that out to all neutraliser bases at once."

A buzz of excited anticipation broke out from the Constructors as the robot left the cupola. Takato remained staring at the chart for a moment, stroking his cheek with the calculator. Then he turned and said quietly: "I hope everything is in order. Good. Then there is nothing for us to do but wait."

Several meals came and went. The Constructors changed watches and tried to get some sleep. Then the receiver in the cupola began to hum and emit signals. They were the standard contact preamble of the Fighters.

"Marshal Takato calling

Director Takato." The call went out again and again. "Marshal Takato calling Director Takato."

Takato spoke. "Director Takato receiving," he said. "Come in Fighters."

"This is Marshal Takato," said the clipped voice. "Greetings to the new leader of the system. Greetings from the man who has been beaten by the Takato neutralisers. Reply. Reply."

"No greetings come from the Moon to the man who destroyed the Venusian satellites, terrorised all who believed in freedom, wasted the resources of the system in wanton destruction, and murdered his wife. Accept the hatred of Director Takato."

"My son," said the voice in the receiver. "Each man must do what he thinks good. I have killed, but I have been beaten. Now I send you greetings from the remnants of the once-proud Fighters. We were glorious in our day. Your day has come. Reply. Reply."

Takato hesitated. He found the conversation repugnant. He thought of breaking it off when an idea struck him. He pressed the panel which cut off transmission and said quickly to Lubkov, one of the Constructors: "Get his co-ordinates quick. He's up to no good, and a blast from the neutralisers will knock out his motors and render what's left of his fleet harmless."

Then he released the cut-off panel and transmitted again: "I do not see the purpose of this conversation. Have the remnants of your fleet come to surrender? Reply. Reply."

Now it was the marshal's turn to hesitate. He pressed down his cut-off panel and turned to the colonel who sat beside him in the control room of the binary.

The colonel answered his glance with: "Keep him talking, sir. I haven't been able to get his co-ordinates yet."

"We should wish to be

treated with all due honour if we were to surrender," the marshal transmitted to his son. "Can you guarantee our lives if we hand over control to you? Reply. Reply."

The Director in the Lunar operations cupola glanced at Lubkov. The Constructor said: "Once more and I'll have him."

"Can you guarantee that you have no aggressive intentions against the Moon?" Takato transmitted to his father. "Reply. Reply."

The marshal shifted impatiently on his seat. He asked the colonel sharply: "Anything yet?"

"Once more, sir," said the colonel. "Once more and I'll have him."

The marshal released the cut-off panel and said: "We have no means of carrying out aggressive intentions. We are entirely at your mercy, Director. Reply. Reply."

In the Lunar cupola Lubkov nodded his head. He scribbled figures on a sheet of

paper as Director Takato transmitted: "I am breaking off this conversation."

In the binary's control room the colonel nodded his head. He scribbled figures on a sheet of paper as the marshal sat, pondering, before the silent receiver.

"I wonder why he broke off transmission so abruptly," he mused. "The sooner we set our course and jettison those motors the better. Give me the bearing of Director Takato's operations centre."

The colonel, a gaunt and hollow-cheeked man, went about the business of feeding the computator with the necessary figures. The answer, in the form of a radial deviation, was transmitted automatically to the other ships.

"Right," said the marshal. "Tell all ships to set on that course. Immediately they have done so, they are to jettison their equipment. This is urgent, colonel, because those neutralisers will be used again, and soon."

The plano-indicator rattled busily as the binary yawed and canted. The stabilising jets spurted for the last time and then stopped. The binary shuddered slightly as the first motor housing floated free and the motor followed. The ships began to settle in the direction of the Moon as a wake of discarded motors drifted up and away from the fleet.

The colonel gripped the chart table. He was losing his sense of weight as the gyro-field faded out. The marshal wedged himself in his chair.

Then the binary gave a sudden lurch. The astrodome glared with a fierce green light. Metal groaned as the Plus spheroid was forced out of alignment with the Minus spheroid. The marshal was lifted bodily and flung against the wall. A robot slithered along the connecting corridor which was distorted with torque, and gasped: "The motors, my lord. The motors." Then the robot's

power source failed and it went limp.

The marshal pushed its floating body out of the way and, with the colonel's help, managed to reach the motor controls. The heat generated by the tortured metal and the fumes which drifted along the corridor from the Minus spheroid made his task difficult. He almost fainted before he managed to jerk down the master lever. The binary bounced once again, hard. Then the last three units of the motor shot away from the ship, each trailing a bright blue plume of light.

"The neutralisers got us a little too soon," panted the marshal as he clutched at a bulkhead. Through the astro-dome he saw the squadron of supply ships and binaries. They bobbed like a ragged line of corks as their blazing neutralised power units floated upwards from them. One mother ship swung away in a maddened parabola, belching golden fire. Then it erupted. The others in the

neighbourhood spun, then steadied themselves and began to accelerate towards the Moon.

"THE NEUTRALISERS were released a little too late," said Lubkov, stepping back from the strato-scanner. "A few seconds sooner and we should have set the whole fleet on fire."

The Director shook his head. "That wasn't my idea. Just as long as their motors are out of action they can't do much harm. Now they'll be drawn in by our gravity . . ."

". . . And crash and kill all their crews," added Lubkov. "Why make it a slow death? Why not finish them out there and have done with it?"

Takato shrugged. "If they stay in their ships and get killed in the crash, that will be their own fault. There is a way in which they can save themselves, and if I know the marshal he won't neglect it.

In fact, he must have foreseen just such a situation. Keep an eye on that scanner, Lubkov. We should not have to wait long."

Takato looked at the bleak, rugged plain in which the cupola and its ancillary buildings were set. In the distance mountains stood, tall and jagged. They formed the rim of the large crater which cupped the plain.

"Any moment now," warned Lubkov, peering into the scanner.

The first ship struck. It rebounded many metres above the strip of levelled ground which it had hit. Then it dropped down again and bounced aimlessly along the strip until it came to rest against a retaining wall. Noiselessly the ship had fallen; noiselessly it had risen and fallen again; noiselessly the retaining wall ruptured and crumbled, as if it were a wafer.

Two other ships spun into view almost immediately.

They looked like pieces of some ungainly mechanism which had fallen apart hundreds of kilometres above the surface of the planet. The cartwheeling binaries tumbled to destruction, a destruction so robbed of sound and of fire as to be almost comic.

Like petals the ships were falling on the horizon. Like leaves they fell in the middle distance. Like boulders they struck the ground near the cupola. They appeared suddenly and silently, but they sent quivers through the ground. The seismograph fidgeted nervously, and one Constructor swore as the plano-indicator on his cinetheodolite was jogged out of true.

But the Constructors said little. An occasional exclamation broke from them; that was all. Every being had involuntarily tucked his head as low on his shoulders as possible. Some had even adopted a crouching attitude. They feared the sudden arrival of a space ship on top of the

cupola. Breathing globes stood within easy reach. If the cupola were to be fractured and the artificial atmosphere inside it lost, they could still survive. The very absence of noise seemed ominous to them.

The first of the crews were falling towards the Moon. Staff officers, communication and supply technicians, robot supervisors—they had all escaped from their ships. Now they approached the planet gingerly, rushing towards it for some metres, then halting themselves like dandling spiders, then falling again.

At first it was not easy to see how they achieved this motion, rather like that of puppets being jerked at the ends of strings. Then the Constructors saw the Fighters' hand weapons. Each Fighter was using his compressed-gas hand weapon as a brake. The little figures were aiming blasts of gas at the plain.

The hand weapons formed clumsy brakes, but they did serve to fight the acceleration

and reduce the velocity of approach. Each little figure jerked to a stop momentarily as he pulled the trigger. Then he fell again.

Some Fighters fell behind outcrops and were lost to sight. Others fell in the open. But they leaped for cover as soon as they had recovered their senses. A few broke limbs as they struck the plain. They either lay still or dragged themselves painfully to shelter. Many of the Fighters hid behind shattered gyro-bearings, sections of reinforced hull, and other scraps of wrecked space craft. Soon a little army had scurried behind the debris of Marshal Takato's fleet. The plain was no longer littered with dead pieces of odalisium, for every fragment had become a barricade and a rallying point of vengeful Fighters.

But soon the ships ceased to fall and the Fighters ceased to flutter down. The plain lay bleak, rugged and menacing about the glossy bubble of the cupola.

"Hand weapons ready," ordered Takato. "Just wait. They'll have to come for us."

Slowly the Fighters came. In ones and twos they flitted from one lump of tangled metal to another. They formed into groups and moved carefully nearer the cupola. They dragged with them one or two of the higher officers who had been injured in the descent.

Inside the cupola every nerve was taut. If only the destruction of the armada had been accompanied by some sound!

"Steady," said Takato. "Don't worry. Wait for them to act first . . ."

His words were lost in the gong-like reverberation which filled the cupola. Simultaneously one section of the dome trembled and turned misty.

The Fighters had fired their first shot.

THE SMALL white disc on the plastilux did not fade, and

Takato realised what this opalescence meant. The delicate plastilux fibres had been permanently strained. Yet they had not given way. The cupola still served as a defensive shield.

His hopes were confirmed by the fusillade of gas blasts which the Fighters rained upon the structure. Small grey and white patches appeared in many parts of the dome. The plastilux even blistered here and there. But the cupola remained intact.

The hollow boom and whine of the Fighting attack came as a startling contrast to the silence which had preceded it. But the noise petered out and silence returned. Constructors rose from behind pieces of heavy apparatus and surveyed the speckled dome.

"What happens now?" Lubkov asked at last. "We sit looking out at them, and they sit looking in at us."

"Give me my breathing globe," said Takato. He

donned the globe and made his way to the inner port. The Constructors flanked the port, covering it with their hand weapons. Takato nodded to Lubkov, who pulled down a lever on the emergency panel. The inner port slowly slid open. Stooping, Takato passed through.

His blue gown was whipped about his lithe body as the air inside the cupola whistled harshly through the aperture. He nodded a second time to Lubkov, and the inner port was partly closed. The air spurted about him with a shrill scream and a faint mist dimmed his view. Then the outer port was slowly opened.

Takato stood at the threshold of the outer port, his gown billowing about him. He no longer had any protection from gas blasts. Inside the breathing globe his small blunt head turned from side to side. He was trying to catch a glimpse of the hidden Fighters.

"Fighters!" he called into

his audio-circuit. "Fighters, your last mission has failed. You came to seek vengeance. We offer you food. You need fight no longer. We have won. Come to the cupola, Fighters, and get nourishment. Come unarmed—as I am."

The Constructors inside the cupola stirred uneasily and fingered their hand weapons. The Director was a very vulnerable figure, and the Fighters still lurked behind cover. The debris-strewn plain was as silent as ever.

After some confused movement and struggling, a squad of Martians, their arms raised and palms extended, moved quickly towards the cupola. They glanced anxiously behind them, but they were not fired upon. In ones and twos, then in dozens, other Fighters began to scurry to the welcoming dome.

Takato peered at each face as the beings squeezed through the outer port. He stopped a major, a man with a pale strained face.

"Where is the marshal?" asked Takato. The major shrugged and shook his head. Takato allowed him to proceed.

"Where is the marshal?" he asked every Martian who came past him. They shrugged or spread their hands. "Where is the marshal?" They did not know. They did not care. What was a marshal to them? They were Fighters no longer. They had done with killing. They wanted to eat.

Takato found himself murmuring: "My father, this must be the bitterest of defeats." Then he caught sight of a small figure painfully dragging itself across the barren ground towards the cupola. The drab grey uniform was unmistakable.

THE DIRECTOR stooped over the hunched figure of the marshal.

"Your legs?" asked Takato. "Are they broken?"

He got no reply. With a

quick heave he raised the marshal and dragged him to the outer port. A few seconds later he was laying his father on the floor of the cupola.

He struggled to unlock the killer's breathing globe. His haste made him clumsy, but at last the globe rolled free. A few Constructors had grouped themselves round the two men. One of them offered Takato his hand weapon, but the Director waved it aside.

"Father," said Takato. "Speak to me. Are you injured?" His voice was strained.

The older man stirred and groaned. His eyes opened, his little metallic eyes. He bared his teeth in a grin as he recognised the face above him. Then he spoke.

"So this is the great Director," he hissed.

"You're hurt," said Takato.

"The great Director," repeated the marshal. He stifled a whimper as he struggled to sit up. He ignored the ring

of hand weapons which the Constructors trained upon him.

"I have a present for you, Son Takato," he said, his voice blurred by clenched teeth. "A present for you," he repeated. He concentrated all his dwindling energy on the movement of his right hand.

The little claw-like fingers dipped into a deep bulky pocket in his uniform. With surprising swiftness he pulled out a small hand weapon. With a last convulsive jerk he closed his finger on the trigger.

He died naturally. He was dead even before the first of the blasts from the Constructors' hand weapons tore into his body.

The Director clutched at the purple stain on the chest of his blue gown. He twisted backwards, so that he seemed to kneel in ecstasy. His head was thrown back and there was a savage smile on his face for a moment. Then his small

body fell sideways, fell across the marshal's feet and lay quite still.

The boom of the Constructors' weapons faded. Again they could hear the air hissing and bubbling at the inner port. They could hear the sodden animal sounds of the Fighters as they gobbled the sticky masses of rice. They could hear a plano-indicator click softly to itself.

But from the two Takatos on the floor no sound arose. They were curiously quiet, these great leaders; they were curiously at peace, even in their twisted attitudes; and they were curiously alike.

THE LAST grey dawn of my life has come, but I pay no attention to the light which comes through the window of my sanatorium. I am looking into the recording apparatus, striving to finish this account of the great solar revolution.

For twenty-three days I have sat before the recorder, summoning up images and

speaking my thoughts. My effort to complete this document for the Solar Records Centre has brought me a strange tranquillity.

Soon the final thought will be fixed on the micro-strip and I shall be able to lie back in my seat and wait for the medical robots. They will start to give me my daily injection of elixir, but I shall refuse it. I need cling to life no longer.

When you scan this record at the Centre you will want to know my name. It is Cha Tabarni.

I am very tired and very, very old. Yet this moment was worth living for. It was worth the centuries of deception and hiding, of standing aside as others suffered. For now the system is at peace.

These solar beings, these feeble, arrogant, lovable children who live on the Moon, on Mars, on Venus and on the Earth, have learned a little wisdom. Killing is no longer a pastime. Work has taken

its place in popular esteem. Now the Constructors are revered as once the Fighters were.

Of course there is still a death lust abroad. The revolution involved so much killing that many Venusians and Lunics, who had never killed before, derived a fierce pleasure from it. Even the Terrists bared their teeth a little. The revolution was a two-edged weapon, as Takato might have put it. Yet its benefits have been great. Now a solar being is conscious of his own innate dignity and his thoughts are free.

The Martians, with their failing for heroes and leaders, tried to raise the Takatos to the rank of supernatural beings. Surely here, they argued, was the very stuff of myth. The Takatos were almost the same person, a killer and a life-giver, two facets of the same character.

And that unknown rebel whose prophecy seemed to bind them inexorably to their

fate—who was he? Might he not be yet another Takato, one of the millions in the system? What a plausible theology could be founded here—a trinity, no less: the god of prophecy, the god of vengeance, the god of salvation.

These would-be Takatians got little sympathy from the Constructors. Although I agree with them I have some sympathy for the Martians. Their love of ceremony and beauty touches a chord in every one of us.

We do not subscribe to a Takatian religion, and that is wise. Some day the system may find a god in whom it can believe, some being whose works do not spring from common roots. Will men be happier then? Perhaps you

who view this record will know.

Perhaps some day beings will explore the farthest reaches of the solar system and not be content with the petty back yard in which we live today. Perhaps they will conquer this whole galaxy and burst out in space towards the other stars.

And perhaps . . . perhaps something very different will occur. The planets may lose contact with each other. Each may try to carry on some sort of life on its own. But I ramble. I have tried to tell you the story of the two Takatos and the great revolution.

And now the story is ended. I must go. I wish you a glorious tomorrow. It is in your hands.

*Had any bright ideas lately?
Little ones can make big fortunes.*

IS THERE AN INVENTOR IN THE HOUSE?

by C. V. JACKSON, F.R.S.A.

In the past, many people have earned themselves fortunes from comparatively simple inventions. The scope for inventors is even wider today. But, first, let us glance at some of the small ideas which have paid off really large dividends.

How about earning £500,000 for inventing a rather finely woven length of string? That was the reward netted by Harvey Kenne for his discovery of boot and shoe laces. The ingenious fellow who followed up Harvey Kenne's idea by fastening small metal tags to each end of the lace, realised a further £30,000 for *his* brain-child.

And, before leaving the subject of footwear, we must not forget the large personal fortune which a bootmaker named Blakey earned with his invention of small, iron protectors for the soles of

boots. Nor the invention of rubber heels by O'Sullivan, an Irish workman, who also reaped a fortune from his idea.

Looking farther afield, but still with our eye on those really small ideas, we find that simple items like the eraser on the end of pencils, the wavy kink in women's hair-pins, the strip of sandpaper on the side of matchboxes, the safety-pin, umbrella-ribs—in fact, a host of small gadgets which we now complacently accept in the scheme of things—have all paid off most handsomely.

Quite a large proportion of these small inventions have been the work of amateurs. Of course, space-travel of the future, nuclear-fission application for peace and industry, and similar advancements demanding highly-involved formulæ and the facilities of expensive labora-

tory equipment, will continue to command the trained scientist and professional inventor.

However, there is no need to be overawed by famous names. We cannot all be Edisons and Marconis, but there is still a host of small gadgets and improvements which greater minds are more prone to overlook. The art of invention does not appear on the curricula of any of our universities. It is more likely to be acquired in the home, the office or the workshop by practical-minded men and women, who see a defect or disadvantage in familiar equipment and begin to think of a means of effecting a remedy.

A great many firms have already appreciated the fact that their own employees are the people most likely to dream up small inventions and ideas to help cut costs and speed up production. Suggestions are welcomed by these go-ahead manufacturers, and fair cash incentives are offered all employees whose ideas prove of practical use.

How to go about getting

these inspirations, you say? One of the simplest ways is to find some small fault which needs remedying. It was a method adopted by the husband who was observant enough to notice that the straight-legged hair-pins used by his wife had a tendency to slip from her hair. He made small kinks in each leg of the pin and found that they gripped the hair securely. He put his form of hair-pin on the market and sat back while they earned him a fortune.

Should an idea occur to you that at first thought appears to be most impractical, do not discard it without having given it really careful consideration. Before now, experts have been known to condemn these impractical ideas out-of-hand, only to discover at a later date that they contained the solution to their problem.

As a case in point, remember that the American, Elias Howe, perfected the lock-stitch sewing machine by having the eye in the *point* of his needle. This was a solution which had been overlooked by others, probably because it

appeared too absurd. Elias Howe saw its possibilities, and it worked!

Another American, named Kopczynski, thought up the idea of oval wheels. Everyone knew that wheels had to be round. The inventor soon disproved this notion by showing how much better his oval wheels were for moving in mud and soft sand. Tractor firms now make his wheels under licence!

Finally, shall we try to name a few things which would still help life along on this old planet of ours?

Speaking as a husband who occasionally helps out in the kitchen, I should think more thought needs to be given to that never-ending chore, washing up after meals. Whether the solution lies in some small gadget for affixing to the kitchen sink, or a cheap, expendable form of tableware, I am sure a fortune awaits anyone able to remove this drudgery.

Again, I am always in trouble at home because I will forget to replace the cap of toothpaste and shaving cream

tubes. What price some form of self-sealing tube for modern paste products?

The mention of shaving cream makes me wonder whether males must always go on spending time, cash and blood in the daily shave routine. Had this been a necessary toilet routine forced on women I am sure a suitable "Smoothchin" cosmetic would be in regular use by now.

Have you ever noticed how quickly collars and cuffs of even good shirts begin to fray? Who is going to be the first to invent a preparation which will reinforce those parts of the clothing which receive undue wear—and something to make them remain cleaner over a longer period of time?

We already have adding machines which add correctly. Who will supply us with typewriters to spell correctly? Or small, pocket tape-recorders on which we may capture fleeting thoughts and inspirations!

Wealth still awaits the man with the bright idea. So, forward, amateur inventors!

He was the only man alive on the ship,
but he was not alone—there was
his conscience . . .

RECOIL

by Harry Warner, Jr.

IT was an emergency on Karl Nielson's first trip through space—and his spaceship was refusing to respond to that emergency. Nielson darted quick, furtive looks around the ship's single, circular cabin. The ship was intelligent enough to take an i.q. test. It still failed to recognise this emergency.

Nielson heard the swishing behind the walls, like velvet-footed, rapid rats, as the sealing units glided tirelessly on their endless rounds between the inner and outer hull, seeking meteor penetrations.

Relays purred occasionally, when the gravitational complex on this Earth-Mars flight inspired the miserly drive compensators to dole out a

scant thimbleful of fuel for course correction. A rainbow array of chemically active substances, sealed in brightly coloured plastics, shifted tints weirdly, causing photocells to send into action hissing and squeaking mechanism that corrected the air's purity, the ship's inner temperature, the humidity, and destroyed odours.

Another photo glided automatically into the receiving trays, as the lens in the outer skin took its latest photograph of the surrounding space. But Nielson's flickering gaze failed to detect any extraordinary efforts on the part of the ship's robot forces. He slowed his breathing with a conscious effort, and told him-

self: Even a modern spaceship isn't equipped to react to a death.

Besides, Nielson thought, this is probably the first spaceship that has ever experienced a murder.

Nielson jerked nervously as a soft chime floated through the ship. His twitch left him staring at Moore's body.

Moore slumped in the pilot's chair, healthy-looking and unmarked. He might have been a tired, sleeping man if it weren't for the awful staring of the eyes. Nielson turned away and tried to concentrate on the chemical control panels. His untrained eyes found nothing unusual in the combinations of hues. But there would hardly be any effect only a half-hour after the death, he told himself.

The chime sounded again, and repeated itself twice. It grated on Nielson's nerves as if it were a cacophonous jangling. He shook his head,

as if to thrust away its echoes, and for the tenth time he told himself:

"I'm only human. When Moore discovered that I'd pulled strings to get a berth on this spaceship, he should have accepted the situation, even if he didn't like it. He should have tried to teach me the things that I didn't get because I skipped the hypno indoctrination, instead of needling me day after day for being so ignorant about spaceflight. He should have known I might fly off the handle from time to time because I hadn't gone through the psych adjustment procedures. All that I wanted to do was to get to Mars the easy way and hunt big game there. I didn't want to cause any trouble."

But Nielson had been driven by Moore's nagging and the maddening monotony of spaceflight and fears of imprisonment upon landing. Nielson had learned enough about the spaceship's engine to know which screens and

shields to leave open in the power room. The beam of radiation had gone unerringly to the pilot's chair in which Moore sat, killing him in seconds.

"Time to talk!" A voice boomed from the 18-inch speaker in the ceiling, commandingly. "Time to talk! Don't put it off!"

Nielson leapt to his feet, arms akimbo, as if the ship had challenged him. Then he opened clenched fists, realising that it was the taped reminder about report time. The report chronometer showed only two minutes remaining, before the report was due, and Nielson remembered now the meaning of the chimes.

A little trickle of sweat ran down the centre of his chest as he tried to gather together his wits. He had a bit less than two minutes to tell the truth or think of an alibi. Space law required twice-daily reports to the nearest planet from each ship in

space, and somewhere on Mars a bored clerk was even now adjusting dials to receive the message from the *Perseus*.

Nielson walked in a circular path to avoid the chair holding the body, snapped on the transmitter, and shuddered at the evil glow of its red sending light. A finger's flick started the *Perseus'* coded tape to sending its endless series of identifying signals. Nielson tried to ask himself what he would say, but could think only of how he had watched Moore go through this routine dozens of times in the preceding weeks:

Something burped inside the transmitter when the chronometer dial showed zero. Nielson heard himself, unexpectedly, talking:

"All's well, aboardship. Fuel dials show safety factor of four six point six. We're three days minus on consumption of vitals. No meteor breaks since last report. Overheating of number seven jet

described three days ago hasn't recurred. Nielson ending."

Nielson's hand froze on the cutoff switch as the box burped again, and a tinny voice came from the small speaking unit :

"One minute," someone on Mars was saying. "Moore is authorised to report from this ship. Put him on."

Nielson stared at the small cone from which the clerk's voice had emanated.

"Put him on, I say. I've got to handle another call in four minutes."

"He doesn't feel good." Nielson wondered if his voice was as badly out of control as his thoughts.

"Then why did you say that all was well aboardship? Describe his illness."

Nielson's eyes turned uncontrollably to Moore's body ten feet away. He forced them away, shuddered, and said : "It's a bad headache. He—he got nauseated two hours ago. He's resting now."

"You sure he can't talk?"

Nielson fought a wild impulse to break out laughing at what sounded like a bad joke. But he managed to inform the man on Mars that Moore definitely was in no condition to talk.

"Damn all two-person spaceships . . . It sounds like a stroke might be coming on. When they certify you for space, they find almost anything else that might make you sick. Wait a minute, while I talk to this other ship." The box went dead for two minutes, then resumed :

"Look at the medical section of your emergency manual and follow instructions. I can't fit you in for another report ahead of your schedule. Be sure to keep a written record of any other symptoms and I'll have a doctor here for your next report. Ending."

Hastily, Nielson shut off the red eye of the transmitter. He had a dozen hours ahead,

during which nobody could possibly learn that Moore had been murdered. It was a secret between Nielson and the spaceship during that time, and if Nielson managed to get his thoughts into order, it might remain known only to him and the *Perseus*. Nielson looked defiantly at the spaceship's instrument-laden walls, as if daring its mechanism to betray him.

It would be easy enough to announce that Moore had died, on his next report. A quick cerebral haemorrhage in space wasn't impossible. In the confusion of landing on Mars, three days from now, Nielson's illegal methods of coming to Mars might pass undetected. But he had to dispose of the body, which must bear tell-tale traces of fatal radiation. Nielson managed to smile grimly at the thought that no other killer had ever enjoyed such an uncountable quantity of quadrillions of cubic miles of empty space in which to get rid of a body . . .

Nielson jumped erect and whirled. Something had moved, just at the edge of his range of vision, along the wall.

Nothing else is alive in this spaceship, he told himself, but he crouched as if ready to flee.

Then he relaxed, seeing a shift in the colours on the detection panels, realising that this had alarmed him. The subdued hum that filled the ship at all times increased in loudness a little, as if the *Perseus* were exerting itself a bit.

Nielson breathed deeper, and understood the cause of the ship's heightened activity. Moore's body was undergoing chemical changes as it sprawled in the chair. The machinery must work harder to keep the air pure and odourless. But the tone of the hum worried Nielson; would the attempt to cope with corruption cause a breakdown?

Nielson remembered the

advice of that clerk on Mars :
 "Look at the medical section
 of your emergency manual
 and follow instructions." He
 decided to obey before
 attempting to get rid of the
 body.

The emergency manual
 was simply a permapaper
 sheet fastened above the
 pilot's chair, listing the index
 of instruction tapes. Moore
 was still slumped in the chair.
 Nielson walked resolutely
 toward the body. He'd have
 to move it eventually, why
 not now?

His knees began to weaken
 when he was four feet from
 the body. Nielson hesitated,
 deliberately forced himself to
 begin another step, then spun
 crazily and wildy backward.

The motion threw him to
 his knees. He crouched and
 whimpered strangely from
 fright. In the nick of time,
 he had realised that the
 radiation was still pouring
 toward that chair. He had
 almost walked into its fatal
 path.

Shakily, Nielson went into
 the power unit housing and
 did what was necessary to the
 screens. The physical exer-
 tion that cut the radiation
 and confined it to its proper
 place restored his self-confi-
 dence. As if it were a daily
 task in space, Nielson then
 pulled the body from the
 chair and rolled it out of the
 way.

Seated where Moore should
 sit, Nielson studied the
 manual a moment, then
 punched three buttons on the
 panel beneath it. The library
 ground into action, with
 splutters and crackling at
 first, quieting as the proper
 section of tape rolled into
 place.

"In the event of death,"
 the recording said, "it is
 essential to dispose of the
 body as soon as possible. This
 will prevent any danger of an
 overload on the spaceship's
 capabilities. It will also
 reduce the psychological bur-
 den on the survivor.

"Pull the red handle which

is hidden behind the nitrogen control panel. This will prepare for launching one of the ship's two life-rockets. The corpse may be placed in this, and . . ."

The voice deepened, and groaned into silence as Nielson cut the library's power. He should have guessed the proper procedure without this reference activity. Shooting the corpse away from the ship in a life-rocket would cause it to fall into the Sun or would shove it into some orbit which would never be tracked. That would prevent all danger of medical examination.

He yanked twice at the lever. Gears ground somewhere, and the gleaming, transparent nose of the life-rocket pushed through a swinging panel into the cabin itself, its entry port smoothly swinging open.

The life-rocket was barely larger than the body of a man. Moore fitted into it as

neatly as if it were a futuristic, translucent coffin. Nielson shoved the port shut—uselessly, because Moore didn't need the air which the act caused to flow—locked it, then pressed the firing stud on the side of the life-rocket.

Nothing happened. Frowning, Nielson jabbed harder at the stud. The life-rocket, bearing the official stamp of inspection for perfect operation, refused to show signs of life.

Moore's face had become terrible. Nielson decided to remove the body and replace it head-first, while attempting to start the obstinate life-rocket. That would save seeing his fact. But the entry port wouldn't re-open. Nielson kicked at it, fumbled with the lock, then realised that it was useless. These life-rockets were designed for living men. They unlocked only from the inside, to insure that the occupant's supply of life-giving oxygen wouldn't be lost by accidental opening.

Nielson tried to shove the life-rocket out of the cabin by sheer force. He strained back and leg muscles, stopping only when his feet slipped on the metal flooring and he fell flat on his face. He lay there, not rising, because his face to the floor prevented him from seeing the face grinning through the transparent life-rocket.

"It can't be that the whole spaceship is conspiring against me," Nielson thought. "I must be doing something wrong. Maybe I've not listened long enough to the tape."

The tireless voice patiently resumed its explanation:

"... in which the corpse may be placed and fired manually into space. As a safety measure, the life-rocket cannot be fired if the spaceship's fuel supply is limited to the danger zone, because the recoil from the firing would cause an unsafe drain on reserves of fuel to resume the proper course for the main

ship. In such a situation, the surviving crew member must evacuate the life-rocket manually, from outside the outer hull. To reach the outer hull, follow this procedure . . ."

Nielson listened dazedly to the complex instructions on climbing into the spaceship's spacesuit, squeezing through the tiny airlock, moving about on the hull with magnetised boots, keeping bearings, avoiding vertigo, saving eyes from sunblinding . . .

He wouldn't do it! He might get out onto the hull and then be unable to find his way back inside. He'd think of some other way to dispose of the body. Nielson snapped off the manual and tried to stop thinking.

But after three seconds, he realised that the manual was still talking. He stared at the switch, which was still in the on position. He shoved it into the off position. It rebounded into the on position. Nielson's eyes had something

wild in them when he pushed over the switch again and pressed it down with all his force. As if the whole ship put its energies behind the switch, the lever rose, tore a chunk of flesh from his palm, and stayed in the on position.

Frantically, he tried to cut the voice once again, unable to bear any more details of how to act on the outer hull. This time a new, more firm voice interrupted the tape's instructions :

"This is an automatic repeating device. Do not attempt to interrupt the tape again. You have chosen an important message which signifies an emergency situation. The repeater will continue to explain your course of action until you break the circuit by following instructions given to cope with the emergency." Then the glib instructions on manually disposing of the life-rocket resumed.

When the repeater tape had begun its account for the

dozenth time, Nielson's shattered nerves demanded relief in the form of action. He defeatedly pulled the space-suit from its closet and slowly wrapped the heavy, resistant folds about himself. Pulling the helmet shut gave him claustrophobia, but it cut off the maddening, repetitious voice.

Nielson went through the procedure as if in a daze, with every detail sealed into his memory by now as surely as if he had received the proper training before coming aboard ship. The airlock controls were operated by a code of heel-taps. His fear of suffocating in the spacesuit was heightened into terror as he stepped into the tiny box that was the airlock. Then he waved his arms wildly for support that didn't exist, as the outer hull opened. The entire airlock slid smoothly six feet along the outer hull. A steel arm of the ship shoved him out of the airlock. It slithered away from him, eluding his frantic grab, and

disappeared into the space between the inner and outer hulls. The gap in the hull closed. Nielson, firmly held to the hull by magnetism, was alone in outer space.

Suddenly fearing that the least movement would send him floating away from the ship, Nielson lay on his back like an overturned turtle. The stars burned through the transparent facepiece of his spacesuit. They were like evil little sparks, more searing and fierce than the friendly, twinkling stars he had seen from Earth.

Inaudibly, a relay clicked somewhere in the ship. The magnetic force that held him pinioned to the *Perseus* altered. The reversed force pushed, first at Nielson's head and shoulders, then at his back and hips. He rose involuntarily, stiffly, like a corpse himself, unable to resist the spaceship's efforts to put him onto his feet. The repulsive force ended only when he stood erect. Only a

mild attractive force kept his spaceboots against the outer hull.

Turning his eyes downward to the dark hull, to avoid looking at the prickling star-sparks, Nielson forced himself to try to walk. No need for caution, he knew. The manual said that the whole setup was foolproof. He could break half of the circuit by lifting one foot, but the other foot wouldn't come loose until he put the first foot down again. That let him walk to the evacuation point without flying off into space.

Wetting dry lips, Nielson stalked in a weird goosetstep toward the life-rocket's firing port. It was only ten feet away. But every pore in his body was streaming with perspiration and his legs were stalks of jelly when he reached it.

Grateful for something to do, Nielson fumbled with the patent lock device on the outer portion of the firing

port. The pin that held it in check refused to come loose to his fumbling efforts with the clumsy, unfeeling gloves.

Neilson straightened and kicked angrily at the mechanism. The pin slipped free. But Nielson staggered off balance from the kick. His kicking leg flailed wildly. He twisted sideways and broke his fall with a back-wrenching twist of his upper body. The leg that held him anchored twisted agonisingly, until his other leg hit the hull, freeing the strained member.

The manual hadn't mentioned the danger of breaking a leg in space.

Cautiously, Nielson bent over the firing port in an elaborate arc, because freeing the pin had cut the artificial gravity in that segment of the ship, and striding onto that portion would mean falling into space. The coffin-like life-rocket slipped easily out of its cradle, almost weightlessly. The body inside was merely a dark mass that

eclipsed some of the stars when the life-rocket came free from its parent craft.

Like a Hercules with a tremendous javelin, Nielson held the ten-foot craft in both arms for an instant, crouched, then straightened and thrust it upward with all his strength.

The patch of blackness among the stars dwindled rapidly. Nielson watched until it reached the apparent size of a full moon. Then he replaced the pin into the lock, re-sealing the port, and cautiously returned to the airlock.

Now that he was ready to re-enter the ship, some perversity caused Nielson to decide that he wanted to see the sun. Carefully, with frequent glances back at the landmark of the airlock, he trudged over the convex surface to the other side of the spaceship that faced the sun.

But the sun rose over the curve of the hull without warning. Nielson yelled some-

thing inarticulately, threw an arm over his face to shut out the fires of the blinding disc, and turned abruptly back to the dark side of the craft.

The moment of looking at the sun had left an angry white after-image on Nielson's retina that refused to fade. Shaking his head, trying to drive it away, he fumbled his way back to the airlock. Two more steps and he might have gone blind, he told himself.

Nielson was kneeling into the prone position that would activate the airlock mechanism when something tapped him on the shoulder.

He threw a startled look around. The spaceship, rotating slowly, had brought the sun near its far edge. A ray flashed through the transparent life-rocket and turned into incandescence Moore's awful face, floating and weaving ten feet above Nielson.

Nielson screamed. The scream, trapped in the space-

suit, set up a resonance that bit and battered at his eardrums. He batted at the life-rocket, like a pygmy trying to ward away a friendly elephant. It drifted away at his blows, landed on the hull with a soundless clang, bounced away again, and floated toward Nielson again.

Forgetting the airlock in panic, Nielson started to run. The safety factor in his boots tripped him before he had taken two strides. He fell flat onto the airlock. The mechanism activated instantly. Nielson felt himself sliding along the hull, into the spaceship, while the baffled life-rocket hovered over its escaping prey. He fainted then.

Nielson woke with a foul taste in his mouth and a hammering within his skull. He was lying on the cabin's floor, where the airlock mechanism had unceremoniously dumped him. The air within the spacesuit was so

bad that he choked and coughed on every breath.

Nielson forced his unwilling fingers to undo the glove studs. Then he lay quivering in nausea, while the rest of the spacesuit unhooked itself automatically.

The fresh air of the cabin was pure bliss when it struck him. The chronometer told him that he'd been in the spacesuit nearly four hours. The things were designed for only three hours of use. Suddenly feeling better, Nielson realised his good fortune in recovering from the faint before he suffocated.

Then Nielson remembered what had caused him to faint. The cabin began to go around in circles and he collapsed in terror onto the floor, curling up into a huddled ball.

"There's nothing supernatural about it," Nielson told himself, when the attack of terror and dizziness had passed. The sound of his own voice helped to restore confidence. "I just didn't

throw the life-rocket away hard enough to get it out of the ship's gravity. It kept coming back. All that I have to do is to cut the whole ship's artificial gravity, go into the airlock, and give the life-rocket a hard push. When it gets far enough away, I'll turn the gravity on again, and the life-rocket will be too far away to be affected by then."

There seemed no reason to hurry with this procedure. Nielson drank a sedative and an analgesic, waited until they had calmed him, then forced himself to chew a few ounces of concentrates.

Automatically, he removed the latest accumulation of photographs from the processing tray of the camera, inserted them into the proper places in the ship's log, and glanced at the statistics that the steel stylus of the printer had inscribed onto the log sheets. All appeared to be going well with the ship.

Nielson's nerves began to

complain again when he forced himself to crawl back into the spacesuit, after equipping it with a new air unit. He steeled his quivering fingers long enough to get the suit properly fastened, and found himself more confident after he was ready for space.

Nielson stamped in the proper rhythm to activate the airlock. There was no response from the *Perseus*.

Fifteen minutes later, Nielson had unfastened his helmet and had listened again to the thrice-familiar instructions from the manual on operation of the airlock. The manual told Nielson that he had done things correctly. The *Perseus*, like a friend turned enemy, simply refused to co-operate by reaction to the proper signals.

It was unbearably hot inside the spacesuit, within the ship, and Nielson feared that he was feverish from oncoming illness. The thought of the life-rocket bouncing

gently or clinging firmly to the hull just outside the ship obsessed him. He clawed at the point where the airlock entered the cabin, attempting to pry it open by brute force.

Hammering and pounding, he finally heard something give way. His lips curled into a grin for an instant, then turned white. The hiss of escaping air told him of the rip in the palm of his space-glove, before he saw where he had torn loose the lining. Now he couldn't go into space again.

He was gazing stupidly at the damage when the warning bell for the next report sounded. Nielson feverishly pulled himself from the spacesuit, hurrying to be on time for the report. His haste widened the tear, ending all hopes of making repairs.

Nielson was seated in place at the bell's second ring. Waiting for the proper moment, he twitched nervously as something pinged against the side of the space-

ship. Lights dimmed slightly as the automatic sealing devices eagerly went to work on the meteor-pierced outer hull. The air pumps didn't start, so the meteor hadn't weakened the inner hull.

When the signal came to talk, Nielson said dully :

"Moore is dead."

The sharp intake of breath from the man on Mars hissed through the little loud-speaker. "That's tough, kid. Have you followed instructions about the body?"

"Of course." Nielson took a deep breath, and suddenly yielded to an overwhelming impulse to confess : "I put up with him as long as I could——"

"Nobody expected you to keep going with a corpse inside the ship," the other interrupted hastily, sympathetically. "The family will understand. As long as you have the body's life-rocket properly hooked to the outer hull, so that it won't break loose from the ship in landing . . ."

Nielson grabbed for his handkerchief, stuffed it into his mouth, and smothered the irresistible laughter that shook his whole body. He doubled up in glee, thinking that he was the most ridiculous, amusing person ever to travel in space. It was ludicrous, he knew suddenly, to have gone through that emotional upheaval, worrying about the way the space coffin followed the *Perseus*. The man on Mars had inadvertently reminded Nielson of the truth : The *Perseus*, no matter how little it cooperated in this emergency with a murderer, would be forced to brake for the landing on Mars, the life-rocket would be attracted by Mars' gravity, and would crash down against the surface of the planet, destroying itself and its grisly contents.

"Hey, take it easy, kid." The voice from Mars fought for Nielson's attention. "Crying won't do any good." Nielson, realising that some of his laughter had been

escaping in distorted form, got hold of himself and said as abjectly as possible :

"Something went wrong. The life-rocket won't hook to the hull. It just floats above the *Perseus*. And I can't go outside again to fix it because something's wrong with the airlock, and I tore the space-suit trying to open the airlock."

Nielson then related in full the happenings since his last report. He told the truth, except to describe a death that sounded like a cerebral haemorrhage.

"Sounds to me as if the life-rocket settled down onto the skin at the airlock and fouled the mechanism. Why didn't you remember the precautions that we gave you when we briefed you before the journey?"

There was an uncomfortable pause. Nielson didn't know whether his improper method of taking this trip was known on Mars. Finally :

"There's one way to be

sure. Have you inspected the photographs? The camera lens is near the airlock. It ought to show what happened."

Nielson reached for the inch-high pile of pictures that had accumulated in the receptacle. He looked through a few, then shoved the entire pile away hastily. Moore's awful face in perfect focus stared at him in most of the pictures, blocking off the stars, floating as if disembodied. Nielson remembered that Moore had told him about the camera's use of infra-red rays for illumination, and the life-rocket was apparently too transparent to register on film.

Hurrying a little now, the voice from Mars said :

"Too bad that the camera record will be imperfect. But the higher brass won't fuss too much, under the circumstances. Look, it's getting late and I've got to go. If you don't get along all right between now and the land-

ing, just punch out your emergency code. That'll get my attention right away." He flashed off.

Nielson spent two hours with the manual, trying to find out what the emergency code of the *Perseus* might be, and how to activate it. He looked dubiously at switches and dials on the walls of the spaceship whose function he was uncertain of.

Nielson managed to eat again a little. But every fifteen minutes, a light flashed from the camera turret, a sheet of paper landed in the little box, and Moore's features stared at him again. Guided by some masochistic impulse, Nielson forced himself to look at each as it was ejected from the development tank. There was no perceptible change in the body. It must have been frozen stiff as a board.

Another meteor's ping against the hull sent the sealing activity into high gear

again. It also jolted Nielson from his latest reverie. Studying the advance log for the *Perseus*, he realised that his ordeal was almost ended. Another day would see him landed on Mars. Trying to account for the passage of time, he decided that he must have slept periodically since the murder.

It was just after the next report period that Nielson conceived another idea. He would lose Moore's body on the descent to Mars, but that planet wasn't very big and the crash might not destroy it totally. Why couldn't he shake it loose from the *Perseus* now, giving it greater momentum for the crash, or sending it into an orbit that would miss Mars altogether?

Nielson listened for hours to the manual's advice on course corrections. He ignored the warning that the ship's own steering mechanism was superior to human reckoning, and the advice that humans shouldn't try to steer the

spaceship without the best of reasons, like sudden immersion into a bad epidemic of meteors. Nielson had heard the meteor ping twice recently, and that should be sufficient excuse for his action.

Stopwatch in hand, Nielson sat in the pilot's seat, hovering his fingers over the rocket firing buttons, practicing without touching them the required series of motions, time after time. He was sweating unexpectedly, despite his confidence that a sudden eccentricity in course would cause the life-rocket to leave the *Perseus*. Nielson shook the sweat from his forehead, and tapped out his design on the buttons.

He hadn't completed the design when he was thrown across the cabin by the writhing spaceship. Grabbing desperately for support, he realised that he had forgotten to strap himself down. The precaution had been too elementary for the manual to mention.

Like a bucking bronco, the

Perseus jumped and whirled in a senseless fashion, as if attempting to wreak vengeance on Nielson. Rockets hooted in syncopated, furious rhythm.

Nielson struggle to his feet, clinging to a ventilation shaft, trying to fight his way back to the pilot's board to release the key that held the pattern of blasts in continued operation. It was like battling a forward path through heavy surf on a crazily uphill beach.

The log snapped from its moorings and whizzed across the floor, as if the *Perseus* had thrown it at Nielson's head. It crashed into the photo device. Evil-smelling chemicals spurted out, drenching Nielson.

The control panel on the far wall was a kaleidoscope of crazily flashing colours. From somewhere above, a spray of vapourised liquid squirted down over the entire cabin, spreading a sickly-smelling perfume for some unknown purpose.

Then relays clicked sharply, commandingly, in the crazed mechanical brain of the *Perseus*. The rockets sobered and stopped their mad bursts of power. The fuel reserves had dwindled to the point past which the ship's subconscious deemed it too risky to continue manœuvring.

The *Perseus* shook itself once, shuddered twice, then continued sedately on a straight, calm course. The keys were still depressed on the panel, but they were useless now. The ship's fuel reserves were at a point which would cause the *Perseus* to obey only its own calculations, ignoring any human attempts to guide it.

Bruised in every inch of his body, Nielson was sick for a time. When the nausea passed, he crawled on hands and knees across the cabin, straightened near the pilot's chair with an effort, and forced himself to inspect the chaos.

The log and photo file contained nothing but a mass of

soggy substances, which vanished as he looked at them, swallowed up by the acid that had soaked them. The photography equipment was broken into large pieces, its last picture still clamped in place in one fragment. Something flying through the room had knocked awry the airlock controls. Nielson instinctively slammed them back into place. As he did, he sucked in his breath at the sudden thought: the controls probably wouldn't have moved if the life-rocket were still perched atop the outer hull of the ship.

Nielson wanted to grin in exultation. But a wave of pain shot through his bruised mouth when he tried to curl his lips in a smile.

With the log smashed so completely, he could announce that he had encountered a spacestorm, a tremendous meteor cluster, anything. No proof of the truth would be existent.

The report bell rang on schedule, as if it were impreg-

nable to the shaking that Nielson had given the *Perseus*. But the mechanism for transmitting and receiving was as dead as Moore. Nielson fiddled with the switches for a moment, and shreds of shattered plastics drifted to his feet from the ruined case.

When he attempted to get advice from the manual, every light and automatic device in the spaceship dimmed or spluttered, as if the *Perseus* were a wounded but still angry beast, sullenly trying to block his efforts. He left the mechanisms alone after that, fearing that he might short out the entire ship and mess up its automatic steering.

The *Perseus* landed on Mars only three minutes and ten seconds behind the schedule that had been set up weeks earlier. Nielson walked slowly through the hole that had been cut in the spaceship's side by workmen, after its automatic opening device failed to work.

"I'm Reynolds," the grey-haired man who met him said, inspecting Nielson from head to foot and shaking his head. "You're one lucky boy. You deserve lots of credit for getting through an ordeal like that without going off the deep end."

"Well," Nielson said, breathing a little deeper because he hadn't been berated for his unorthodox method of getting aboard ship in the first place, "I want to rest for a while. It's been a hard time."

A swarm of technicians were scuttering through the gap into the *Perseus* to study its condition and determine ways to make future trips less liable to similar mishaps. More leisurely, two burly fellows were unloading the personal possessions of Moore and Nielson.

"I have reservations at the Spaceman's Retreat," Nielson hinted. He shifted weight from one foot to another, fearing to press his good luck too far by chatting here.

"Wait a minute," Reynolds ordered. He examined a sheet of paper that someone had handed him. After holding it close to a strong light, he motioned the strong men to stop carrying away the boxes of personal effects. At his signal, they began ripping open the cases.

"But I don't want to unpack yet," Nielson began confusedly. The conglomeration of cameras, clothing, firearms and guidebooks that Nielson had brought for his expedition looked strange in the combined light from a distant sun, two nearby moons, and artificial lighting.

Reynolds selected the revolver, picked it up in his handkerchief, and stared fixedly at Nielson:

"Are you going to tell the truth now, or wait for a formal questioning?"

Nielson looked at the battered *Perseus*, as if it had been whispering to Reynolds, telling tales from its mutilated memory. The ship

loomed menacingly, motionless behind him.

"The truth?" Nielson finally succeeded in muttering to Reynolds.

"Yes, about shooting Moore. If you'll confess and give your motive, you might get off with life imprisonment. You could help us to determine why any man should kill another man in space. This is the first time such a thing has happened, you see."

"But you can ask the man on the report board. I didn't kill Moore. I haven't touched that gun since I left Earth. Moore died of a stroke." Words suddenly were spilling volubly from Nielson. "I had to put his body into a life-rocket so that it wouldn't ruin the chemical processes of the ship, and then it broke loose when I tried to get out of a meteor storm. You can hunt for the body. You'll see there isn't a mark on it. If there isn't a mark on it, I couldn't have shot him."

"Nobody can examine the body," Reynolds replied. He sniffed at the gun and looked puzzled. "The life-rocket crashed before you landed. There wasn't even a shred of bone left from the smash-up. Say, how did you manage to fire this gun without leaving an odour of powder?"

"But I tell you, it hasn't been fired. I bought it to go hunting with. Moore died naturally. I can show you exactly where . . ."

Nielson turned toward the *Perseus* to demonstrate where Moore had first complained of illness, where he had lain during the first report, all the other features of his carefully thought out alibi. But arms grasped him. He struggled uselessly, and Reynolds shoved the sheet of paper beneath his nose.

"You forgot to destroy the last photograph before you

wrecked the photography equipment. It shows the bullethole in Moore's forehead, as plain as day."

Nielson looked at the photograph, and wondered whether something were snapping inside himself. The photograph, the last taken before the life-rocket was buffeted away from the *Perseus*, showed with perfect clarity the clean, small wound in Moore's head, just above and centred perfectly between the eyes. The wound couldn't be there, but the picture showed it.

Reynolds shook his head sadly. "I'll say one thing for you—you're a good shot." Then he turned away from Nielson, and said to a technician standing by: "He couldn't have made a cleaner shot. You'd almost think that Moore had been hit in the head by a little meteor."

LOGIC IS FUN—4

by FRANK WILSON, B.Sc.

As many of us know to our great disappointment, the fact that A loves B does not necessarily mean that B loves A!

In other words, the *relation* of loving does not necessarily work in both directions. Given that it works in one direction, we cannot tell whether it works in the other; it may or it may not. Generations of daisy-petal pickers have been concerned with this problem.

The technical term for the type of relation that may or may not work both ways is *non-symmetrical*. Such relations have the logical property of non-symmetry. It is with the logical properties of relations that we are now going to deal. The example given above shows how simple it all is really. You probably already know most of it; this article will merely give you

the technical terms and the logician's particular slant.

You will, of course, be aware that relational arguments are extremely common, in ordinary life as well as in scientific disputation. Lack of knowledge of the logical properties of relations is responsible for a considerable amount of sloppy, dangerous thinking and unscientific dogmatism. When you have read this article, examine afresh some of your favourite political and religious texts. You may still believe in what they say, but you will probably find it difficult to maintain that they are logical!

Thus, even though this article is designed merely to make you acquainted with the raw material of relational logic, yet it may nevertheless help you in being a bit more sensible — always assuming

that you *want* to be more sensible, and a lot of people don't; it's so much easier on the intellect to be stupid!

Now, we have already seen that one of the logical properties of certain relations is non-symmetry. This property, let us say again, belongs to all those relations that may or may not work both ways. In addition to loving, we can have hating, brother of, implies, etc. In all cases of non-symmetrical relations you are told that the relation "goes" in a certain direction (e.g. *from A to B* in A loves B), but you cannot tell, from what you are told, whether the relation also goes in the reverse direction.

Sometimes you *can* tell this. For example, if you are told that A is equal to B, you can immediately know that B is equal to A. Or, if you are told that the Earth is 93 million miles from the Sun, you can know straight away that the Sun is 93 million miles from Earth. Thus we have

here relations which do (and *must*) work both ways. They are said to be symmetrical. A relation is symmetrical if it goes in both directions, if you can turn it round, so to speak, and make it work the other way.

But if you are told that A is the father of B, you can immediately say that B is *not* the father of A. Or if you are told that Jupiter is larger than Mars, you can straight-away tell that Mars is *not* larger than Jupiter. These types of relations are said to be *asymmetrical*. A relation is asymmetrical when it *cannot* work both ways. Given that it goes in one direction, it automatically follows that it does not go in the other direction.

These three types—symmetrical, asymmetrical, non-symmetrical—form one way of classifying relations. There are other ways. One other way of classifying relations is upon the basis of their *transitivity*. In this, the point

at issue is whether a relation holding between two pairs of terms will hold between terms selected from the pairs.

Suppose, for example, that A is the ancestor of B, and that B is the ancestor of C. Then it follows that A *must* be the ancestor of C. Thus, the relation "ancestor of" holds between two pairs of terms and between a pair selected from them. It is a *transitive* relation. You can see quite clearly that if Mercury is next to Venus and Venus is next to Earth, then Mercury is *not* next to Earth. Relations such as "next to" are *intransitive*. Intransitive relations are those in which a relation which holds between two pairs of terms *cannot* hold between terms selected from them.

Now suppose that you were told that the gravity of Earth is different from that of Mars, and the gravity of Mars is different from that of Jupiter. What can you say about the gravity of Earth and Jupiter?

You cannot, from what you have been told, say anything. You cannot say whether the gravity of Earth is different from that of Jupiter or not. There is nothing in what you have been told to prevent their being the same—or different. Such relations are called *non-transitive*. A non-transitive relation is one in which the relation that holds between two terms may or may not hold between a pair selected from them.

You will have noticed, probably, that we have described three types of transitivity that take the same form as the three types of symmetry, giving six types in all.

These two different kinds of properties—symmetry and transitivity—are not mutually incompatible. A relation may possess any combination of the two kinds of property. In all, we can have nine different types of relation, based upon these two kinds of properties. Here are some examples of each type :

Symmetrical transitive : equal to, simultaneous with.

Symmetrical intransitive : spouse of.

Symmetrical non-transitive : different from, not equal to.

Asymmetrical transitive : larger than, older than, above.

Asymmetrical intransitive : father of, son of.

Asymmetrical non-transitive : greater by one than.

Non-symmetrical transitive : implies.

Non-symmetrical intransitive :

Non-symmetrical non-transitive : employer of, lover of.

You will notice that I have not given you examples of non-symmetrical intransitive relations. This is to give you an opportunity of finding some for yourselves!

A third and extremely useful method of classifying relations is based upon the

number of terms to which a given term may stand in the given relation. For example, in the relation "twin of," there is only one term on each side, so to speak. If A is the twin of B, A cannot be the twin of anyone else, and neither can B. Such a relation as this is called a *one-one* relation, rather appropriately, you will agree. One-one relations are of tremendous importance in science, for correlation depends upon them and the whole of mathematics is built around them.

When anything is described definitely, a *one-many* relation is involved. For example, "The father of modern science" describes a person definitely. It contains a one-many relation because although modern science (or anything else) can have only one father, the father may be parent to many things besides modern science (or anything else). There is a one on one side and a many on the other, so to speak.

Sometimes this condition is reversed, and then we have a *many-one* relation. "Subject of the Queen," "Crater of the Moon" are both examples of many-one relations because there may be many subjects or craters, while there is only one Queen or Moon. We still have one on one side and many on the other, but they are on different sides now.

A fourth and obvious type of relation is the *many-many*. In such relations, there may be many terms on one side and many terms on the other side. "Citizens of European countries," "Masses of the planets" are examples of many-many relations.

Now, since in previous articles in this series I have given you the orthodox symbolism used by professional logicians, you might as well have the complete picture by including relational symbolism—remembering all the time, of course, that symbolism is merely shorthand, a

quick way of writing something that would be cumbersome in words. Never be afraid of any kind of symbolism—no more than you are afraid of other contractions such as etc., i.e., e.g., and so on. Once you know what the symbols mean it's as simple as *pi*!

A relation, *any* relation is represented by *R*. It could hardly be simpler, could it? The terms between which a relation holds are designated by italic letters from the end of the Roman alphabet—*x*, *y*, *z*. Thus, a relation such as "John loves Mary" would be symbolised simply by xRy . That's all there is to it, but it makes for very convenient handling.

For example, we can express our classifications of relations in the following manner:

A relation is symmetrical when, if xRy then yRx . A relation is asymmetrical when, if xRy then not yRx . A relation is non-symmetrical when,

if xRy then maybe or maybe not yRx . A relation is transitive when, if xRy and yRz then xRz . A relation is intransitive when, if xRy and yRz then not xRz . A relation is non-transitive when, if xRy and yRz then maybe or maybe not xRz .

There are one or two more terms used in dealing with relations that you should know. The direction in which a relation "goes" is called the *sense* of the relation. Thus, in "John loves Mary" the sense goes from John to Mary. The term from which the relation goes (John) is called the *referent*. The term to which it goes (Mary) is called the *relatum*.

Every relation has a *domain*, a *converse domain* and a *field*. The domain of a relation is the class of terms which have that relation to something. The domain of "loves" is extremely wide, for many people love someone or something. The domain of "paternal aunt to" is not so

wide, for much fewer people are paternal aunts.

The converse domain of a relation is the class of terms to which something has the relation. Again, the converse domain of "loves" is pretty wide, for nearly everyone and everything is loved by someone. In the case of the relation "paternal aunt of" the converse domain is just as wide as the domain, for there must be as many of this kind of niece as there are this kind of aunt.

The field of a relation is simply the sum of the domain and the converse domain. The field of "loves" includes all the world's lovers and all the loved ones. The field of "paternal aunt of" contains all the paternal aunts together with their nieces.

One final property of relations that has a certain amount of importance is *connectivity*. Given the relation "son of" and the field "human beings" we cannot tell

whether any particular human being is the son of another. In other words, we may not deduce that *any* two terms in the field of this relation are linked by it. We may know a paternal aunt and a niece who has a paternal aunt, but that does not mean that these two friends of ours are related in this way to each other. Sometimes, we can deduce this, and then the relation is said to be *connected*. Symbolically, we may say that a relation is connected when, given any two terms, x and y , in its field, then either xRy or yRx .

We have now more or less covered the groundwork of deductive logic. True, we have barely touched upon the various topics, and have avoided as far as possible the controversial points. But we have laid a solid framework on which those of you who wish to push further may build.

Next month we shall move on to the absorbing topic of scientific method—inductive logic—and deal with such interesting subjects as causation and hypotheses; matters which form the backbone of experimental science.

LOGIC by E. C. Tubb

is next month's feature novel. Other stories include *Forgive Them* by Dan Morgan, *Asteroid Crusoe* by Jonathan Burke, *Insomnia Cure* by E. Everett Evans, *The Jar of Latakia* by Edmund Cooper, and *Science Fiction Story* by Richard Wilson. All the usual non-fiction features.

AUTHENTIC — A MONTHLY MUST!

"I'm not fated to die yet"
said the dark stranger.
But little did he know
it was his

LAST JOURNEY

by VERONICA WELWOOD

THE lean brown chap arrived at the lock at the same time I did; he was a stranger to me, and I thought I'd seen everyone in the colony, but we nodded a greeting as we stepped over the threshold into the evacuating chamber and took our suits off the hooks. It's a damned nuisance having to wear full space-armour on Mars—theoretically, all you really need is an oxygen mask. But just try going out in that dust in ordinary clothes! They even have a triple lock at the city gates: nothing else would keep out the fine red powder that blows gently and eternally over the planet.

"You're new here?" I said, as I helped the stranger on with his helmet.

"New *here*," he repeated. I think there was a word or two after that, but the air was thin, and we'd broken physical contact for the moment, moving forward into the next lock.

While we waited, I touched my helmet to his. "Going my way? I'm off to the port—got some work to do on my ship." I might as well have his company; it's a long walk, about four miles, and only the nobs can afford any transport but Shanks' pony. You see, you can't navigate by landmarks because of the dust—which is like a good indus-

trial-city fog on Earth—and any transport has to be enclosed and airtight and have at least horizon-range two-way radio. It costs plenty when all that stuff has to be brought up from Earth. But, if you like to walk, your suit walkie-talkie is enough to keep you on the beam.

"That way as well as any," he mumbled. Non-committal kind of cove.

"Been here long?" By this time we were out of the third lock and our radios were on.

"Too long. Or not long enough." He still wasn't giving much away.

"Why? Getting homesick for the green and blue of Earth?"

"Maybe. Or wandersick for outer space."

Not only non-committal but darned annoying. I felt I had to make him talk like a human being instead of a cryptic ghost. It isn't generally considered good manners to ask too many questions on Mars—a lot of us feel safer

as anonymous nonentities—but I couldn't see us going on like this for the whole hour it'd take to reach the spaceport.

"I guess we all feel like that, a bit," I chattered. "Not much chance of it, yet. The backroom boys are bumping their noses on a lot of dead-ends, and I reckon you and I won't see the end of the search for a cheaper fuel that'll take us further on. If it wasn't for the radioactives here, we'd never have got finance to take us this far. You in the mining end of it, or transport?"

I heard him give a dry laugh before replying: "Cagy as ever, like the Portuguese merchants and Columbus. The backroom boys could give us something tomorrow if they put their minds to it—but no one'll finance research until Mars is mined out, same as no one'd really get down to making spaceflight a going concern until Earth's resources were on their beam ends."

"Sounds as if you might know one end of a ship from the other, then. What model's your job?" There seemed to be a crack in the oystershell.

"Rebuilt Mark VIII—Navy disposals from the Last War. She wants new tube linings, but she's a decent old tub."

"Mine's older—Mark VII. Gyro's bung; that's what I'm going to fix today, with any luck. The stores super says some new stuff's just in on the last supply ship, and I've a few ducats saved up. Say, can you hear the beam? I must be a bit deaf or something——" I broke off in sudden alarm. You know how it is with a constant noise like that; you don't hear it after a while, unless your attention's drawn to it—but when it disappears you realise something's wrong.

The stranger looked blank for a moment. "Can you hear the beam?" I repeated tightly.

"No. No, I haven't heard it for about the last three or

four minutes." He didn't seem to realise it was important.

I exploded: "Then why the hell didn't you say something? We might be a hundred yards to a quarter of a mile off-track by now. Here, stop; there's no point in wandering farther out."

We stood still, looking around. Pretty useless, unless someone else happened to loom up, since all we could see was yellowish-red mist, cutting out vision at about ten yards. The sun's position wasn't definite — just a luminous patch a bit yellower than the rest, giving a hardly perceptible shadow. The dust is fine as talc, and what isn't flying around is about six to eight inches deep on the ground. It never packs hard, is always shifting—there just isn't any track. There's only one good point about Mars dust—it isn't very abrasive, perhaps because it's knocked round so long and got ground down so fine. Because it is fine, practically no seal

will stand for long against it unless kept damp. The technicians patrol the colony walls and gates constantly, but even so some of the damned insidious stuff gets in, somehow. I remember Bluey Mackerras' wife, when she had to go home . . . it was the eternal dust. She just couldn't stand any more of trying to keep their little room decent; it was getting in Bluey's lungs, too, though he thought she didn't know. I had a letter from Blue last mail; she's got over the worst of the hysteria now, but they have to live in a steaming jungle. The least suspicion of dust starts her off again.

"We'll be all right," said the dark stranger. "I'm not fated to die just yet."

"Isn't that nice for you?" I snarled. I was pretty scared, and his calmness riled me. "I haven't as much faith as you have in Fate. God helps those who help themselves—and we'd better get started. Time's just on 1100 hours; let's see: sun on the right—that's O.K.

We must be facing about parallel to the beam . . . but we don't know which side. Best to separate, keeping radio contact, and see if we can pick it up. You go that way, straight towards the sun; I'll go the opposite way. Contact by alternate letters every two seconds—you say 'A,' wait till I say 'B,' then say 'C'—and listen for the beam signal as well. Stop walking the minute *my* voice starts to fade, or we'll be lost properly."

He looked at me with a queer little smile, waved his left glove, and faced toward the sun, walking slowly. "A," I said . . .

I plodded through the dust. You don't sink much, because even with space armour the weight isn't too much on Mars, and the big "snowshoe" boots distribute it. I concentrated on keeping the faint shadow of my body straight ahead, walking away from the sun, and mechanically uttered, as I heard the

stranger's replies, "C," "E," "G" . . .

There isn't any danger along the beam track; it was planned that way, carefully surveyed. It's away from the track that you strike trouble. I suppose I was concentrating so hard on keeping that shadow just right, so I wouldn't walk in circles, and on hearing the letters and listening for the beam, I never thought of the crevasses. They're a bit like the crevasses on Earth glaciers—only instead of being covered in snow, that damned dust fills them and covers them; they look no different from the rest of the desert.

It came so suddenly I just didn't know what was happening. I even uttered the letter "W" quite automatically as I went down, and remember hearing the stranger's "X" before something hit me and I passed out. I suppose my helmet struck the side of the crevasse.

I must have been unconscious about two minutes. It

was black as the inside of a cow when I came to; I was buried in the light dust filling the crack, and my knees and back were wedged against the sides. Very cautiously, I moved my hand and switched on the headlight, and at the same time heard the stranger's voice, coming nearer, I thought: "Where are you? Mark VII, come in. Mark VIII speaking. Where are you?"

"Stop. Stop where you are, Mark VIII. I'm down in a crevasse. Stop before you fall in, too. Did you hear the beam?"

"Not out my way. I went about two hundred yards from where we parted, then suddenly your signal cut out. I am now five hundred yards from there, walking with my back to the sun."

"You must be pretty close, then. Stand fast for the moment. Don't happen to have a rope, do you?"

"No—but I can make a cable from my suit-wiring—"

"Don't be crazier than you

can help. Let's think this out." There was silence for a few moments.

I spoke again: "We've no chance of finding the beam, I reckon. At least, one of us hasn't. Even if you get me out, I'm no good; broken leg, I think. I'm not going to move it to make certain, though. You'll only get lost trying to find the beam on your own. Since there's a crevasse here, it must be at least five hundred yards in the opposite direction, towards the sun. The beam path's supposed to be clear of crevasses at least a quarter-mile on either side. Best to wait until night and try to make out the colony beacon; it should show up a bit, even in this hellish murk. Then get help."

"How far down are you?" he asked.

"Dunno. I daren't move more than my fingers, in case I fall further."

"I'm coming over—all right, all right," as I began to expostulate, "I'm crawling

on my belly. We need contact, you see," he went on, and I could hear the brushing of his hands and knees over the dust. "The radios ought to be saved for later, when we need them; my battery's only got about two hours' life. How's yours?"

I hadn't thought about it. "About the same, I think. I was going to get a recharge at the port." I felt a slight vibration through the rock at my back. "Look out. You must be on the edge now."

A space-gloved hand touched my shoulder gropingly, then my helmet. Faintly, I heard his voice: "I've switched off now; you do the same. Can you hear me?"

"Yes. Unscrew your aerial, touch one end to my helmet, the other to yours; that'll improve things a bit. The air doesn't carry much sound."

So we settled down, the stranger—Mark VIII, as I was now calling him—lying on the ground by the crevasse, and I, growing more numb

each minute in my dusthole. We had about five hours to go. I felt I was probably going to lose that leg.

"This reminds me of the first time I climbed Everest," Mark VIII began. "Bob Greenburgh got stuck down a crevasse, daren't move for fear of going further. We got him out by . . ."

I interrupted. As far as I knew, hardly anyone had bothered with Everest since its first conquest about a hundred and fifty years ago. "You climbed Everest? When was this? I thought nobody'd tried it since Adam was a pup."

"Oh, this was a long time ago . . . no one knew much about it. Well, Bob was stuck there, knees braced on one side, back on the other, slowly freezing——" he went on with a long story, of which I didn't hear the end because I fainted. Now that the taciturnity had broken down, he didn't seem to notice my lack of comment, and I came to just as he was, apparently,

in the middle of some other yarn: "—so at last we got the old 'Endeavour' off the reef, and went sailing on, with a man in the chains every hour of the day, sounding the passage, and lying hove-to at night. Some of the most dangerous sailing on Earth, there. It wasn't until we had rounded the cape into Torres Strait that Cook officially named the coast 'New South Wales'——" I dropped off again, partly from the pain of my leg, and partly because the air was getting a bit thick. Apparently, I remember thinking as I drifted away again, the dust's affecting the de-humidifier.

He was still talking when I came up for the third time; as I listened, trying to take my mind off the leg, it didn't seem to make much sense—we don't fight any more, since the Last War, and even then it wasn't on horseback with lances, against someone called "the Infidel." "I hadn't," he was saying, "seen the Holy City since that last day, the

day of the curse. Fool that I was, I thought my sins would be forgiven, and that as we rode triumphant to pray at the Sepulchre I'd find rest at last. They had a good propaganda machine in those days——" He laughed cynically.

Am I delirious, I thought, or is he? Or just a good tale-spinner, once he gets going? "What's the time?" I asked.

"The sun's just going down," the stranger replied. "Are you comfortable? It will be about half an hour before I can see the city lights—if then."

"As well as can be expected," I grunted. "As they say in hospital. How's your air? Mine's a bit foul—I think the humidity exhaust's stopped up."

"Fine, fine," he said. "Wait a minute—I think I can spare about a couple of hundred c.c.—it'll keep you going until I can get help." I felt his fingers turning one of the inlet valves on my helmet, adjusting the tube

from one of his oxygen bottles. "I'll use up what's left in my spare—there's a bit left. Problem now is communication."

"Is there any sign of the lights yet?" I asked.

"I think I can see them—to my right, maybe a bit over a mile—hard to tell in this murk. You keep your radio on all the time now, or you might pass out while it's off and leave us without a marker. I'll walk to what I estimate as half-way, still in range of you, and try to raise the gate guard. So we'll have an unbroken line. It's lucky you aren't further down, or there'd be too much 'shadow' for a small job like this—your aerial comes about six inches above the edge. Anything more I can do before I start?"

"Thanks. You're a good scout, Mark VIII. Best of luck—hope you make it."

"I'll make it—don't forget, Fate doesn't intend me to die yet. Cheero—see you in about an hour or so, when they bring the ambulance."

Faintly, I heard his footsteps as he trudged off through the dust.

I suppose I went off again then. All I remember before waking here in the ward is a monotonous voice calling: "Carter, Carter, come in Carter," and replying with a few grunts and groans before going off again. It must have been enough—they found me.

Anyway, how's Mark VIII? I'd like to thank him if he's around . . .

"Dead." What do you mean, dead? He was all right, wasn't he? He sounded O.K. when he went off for help——

I see. Yes, I'd forgotten the air. Just enough to give the alarm, then collapsed . . .? I'm sorry about that; he was a decent bloke. "Greater love hath no man" and all that stuff. But *why* should he have done it? We didn't know each other, we'd only just met . . .

Because I listened? Yes, I guess a bloke like that wouldn't find many listeners

up here—we're generally too busy to listen to another man's troubles. He told you, did he? I'm glad he didn't know that I wasn't listening, most of the time. What else did he say?

"I'll rest from wandering at last." Queer thing to say—according to the scraps of his story that I heard he'd done considerable wandering. It was only romancing, of course—most of what he talked about happened long ago, before any of us were born; he seemed to have a yen for history. What was that guy's name, anyhow? I'd like to look up his people when I go home, and see what I can do for them. He saved my life, that's sure.

A bit like mine, isn't it? "Cartophilus"—sounds like a Dago name—Greek or something.

Jewish? The traditional name of the Wandering Jew? Rats!

But where did he get those yarns he told . . .?

The London Circle

by H.J.C.

No matter what anyone says about the London Circle—and some have said some most uncomplimentary things—it exists. Tenuous, amorphous, aimless and proteus, it yet is there for all to see and join. No other club can be joined so easily. All you have to do is walk into the saloon bar of the Globe Tavern, Hatton Garden, London, E.C.1.

Mind you, no one will tell you you have become a member. There will be no ceremonies, no rituals. You will be treated just like anyone else who happens to drop in, except that someone may mention science fiction to you. The London Circle has no officers, no dues and no obligations or responsibilities. They, it, we, you meet every Thursday evening at the Globe for the sole purpose of being friendly in good company with stimulating conversation and mellowing refreshment.

Nobody goes out of his way to make newcomers welcome. Everybody pulls his own weight. Everybody "gets in on" conversational groups that interest him—and then drifts to other groups to find out what the blazes these queer-looking types are getting excited about. Everybody gets his horizons broadened and his judgments narrowed.

For those who just can't sit still and talk there are always haggling groups trying to get rid of back numbers or trying to acquire them, or just haggling for the mere love of it with no intention of buying or selling. Books, too, are there for sale or barter. Quite a lot of this literature is science fiction.

But maybe the most definite characteristic of the London Circle is its freedom from the over-serious approach to science fiction that categorises and stigmatizes one or two provincial set-ups. Here there

is no fanaticism, no hero-worship, no distorted perspectives—at least where science fiction is concerned. Cranks there are indeed, but they are *sensible* cranks, if you see what I mean.

The London Circle also differs from all other fan groups in that there is a strong professional element attached to it—parasitic, in the view of some fans! But, of course, the professionals are fans, too. Until he went to America early this year, Arthur C. Clarke was a regular attender. So are William F. Temple, John Wyndham, Peter Phillips, Bryan Berry, E. C. Tubb, Kenneth Bulmer, John Christopher, Sidney Bounds, Jonathan Burke and practically every other London professional author you have ever heard of. John Carnell, my chief rival and very great friend, editor, anthologist, trooper, still comes regularly to the meetings that he helped to start so many years ago. If *you* come along—and I do hope you will—you'll see John and me arguing about

what is good science fiction—and agreeing to disagree as we call for another pint!

In spite of the many professionals present, the Globe meetings are entirely informal and absolutely free from any kind of snobbery or condescension. The pros and the fans mingle on a perfectly equal basis of harmonious fellow-feeling.

Now, the London Circle is open to everyone. It doesn't matter where you live or where you were born or what colour your skin or what God you believe in or none at all. You will be welcome at the Globe any Thursday of the year. But do make yourself known as a science fiction fan. It's very easy for people to come in and be ignored for the whole evening—there is no reason why non-interested strangers should be accosted, is there? So carry a science fiction magazine, or go up to somebody and ask them how a rocket works, or something along those lines.

But I warn you—if you come once, you'll come again!

*How'd you like someone to do
every little thing for you?
Wouldn't you wish you were dead?*

SERVANT PROBLEM

by T. D. HAMM

HENRY SMITH stared morosely at Servo.

Servo stared back at him with his eager, painted smile. (Finish guaranteed permanent.) Sometimes Henry thought he disliked the servile smirk worse than anything else about the Perfect Robot.

"It will," the salesman had said blithely, "anticipate your every wish."

And it did, too. For a while it had been exciting to reach for a cigarette and find one snatched from the box, lighted with a motion too quick for the eye to follow, and deftly inserted between his lips. Or to reach for his slippers and find his shoes gently removed and the slippers on his feet. Or to wonder where he had laid down the

latest *National Geographic* and find it in his hand open to the page he had last finished. Or . . . but why go on through the depressing chronicle of perfection?

Carefully indoctrinated to remove anything that might give Henry discomfort, as well as to anticipate his wishes, the robot's delicate mechanisms were attuned to the owner's encephalographic patterns with an almost incredible minuteness that a century ago would have smacked of black magic.

Having a personal devil, Mr. Smith sometimes reflected moodily, would have been preferable; at least one could have dissolved the pentagram and seen the familiar vanish in a puff of sulphur.

There was no such éasy solution here; to begin with, Servo had not been Henry Smith's own idea. Unfortunately, Mr. Smith was an essential cog in his country's security. It had not been thought advisable that a human servant should be in such close, familiar contact with the repository of such vast, s e c r e t knowledge. Human servants might conceivably be bribed or terrorised. Also it was imperative that the Great Brain should not be distracted by performing small, menial duties himself. Hence, Servo. Mr. Smith thought of the divine imperfections of the dour, tyrannical Alfred whom Servo had replaced, and sighed regretfully.

He began to struggle against his benevolent tyrant. Occasionally by humming a careless strophe and exercising a careful mind-block he would succeed in diving headlong into the bathroom and taking his own bath,

while Servo tapped gently at the locked door.

For there never was any violence in Servo's reactions. Everything was done quietly, gently and perfectly. When Henry, after one of these successful sorties, would emerge, Servo would be standing there, smiling his eager smile, waiting for the next wish. Mr. Smith found himself yielding to the state of mind that impels one to kick a cringing dog.

And there was no escaping him except at work. Every morning a magnificent, official car arrived at Mr. Smith's door and whirled him to the very entrance of the little cubicle which had come to seem to the harassed little man a haven of refuge from the comfortable apartment with its ubiquitous attending genius.

Here Henry Smith was in his true element. As the beautiful, exact equations unrolled in their unwearied perfection, he hummed

happily like a fly in a bottle, a tuneless score to the magnificent libretto unrolling under his pudgy little fingers.

And all too soon the hours unfolded, the day ended, and the car whisked him back to the tender ministrations of Servo. Mr. Smith was ashamed to complain to the powers above him. How could one explain rationally that a perfect robot was driving one mad? He lit a cigarette abstractedly and cursed mildly as the flame crept unnoticed along the sliver of wood and burnt his finger. He regarded it with morose satisfaction; at least he was still permitted to burn himself outside his own room!

Invariably, since the advent of Servo, Mr. Smith's day began inauspiciously.

Breakfast and dinner were brought up on trays by the hotel staff and turned over to the eager care of Servo. A large glass of orange juice started the day (in itself a

proof of his status in a country where fresh fruit was only a fond memory), followed by two hot, crisp slices of toast, and a cup—one cup—of black coffee.

This was a major irritation on each succeeding morning. Mr. Smith was very fond of coffee. Before the advent of the perfect servant it was Mr. Smith's custom to drink two large breakfast cups of the steaming brew. Gently he spooned in large helpings of sugar; tenderly he added cream to just the right amount of whiteness. The authorities, however, noticing Henry's growing state of nerves, had insisted on having him examined by an officious doctor, who declared that he was ruining his digestion with the concoction and had stipulated one cup only . . . and that without cream and/or sugar. The hotel kitchen . . . and Servo . . . had been duly appraised of this fact, and Mr. Smith each morning made a wry face as he sipped the bitter, insipid brew.

On this present morning, however, Mr. Smith surveyed his tray and his eyes widened with shock and pleasure. There in its place reposed a large silver jug . . . of cream! Mr. Smith could hardly believe his eyes. Hastily he tipped the jug generously over the waiting cup. With trembling hands he lifted it to his lips, inhaling the rich bouquet . . . A large plastic hand gently insinuated itself between mouth and cup and lifted it out of his reach. Mr. Smith went a little mad.

Nearly weeping with rage and frustration, as the precious liquid gurgled down the drain, he threw himself on the monstrosity, kicking and pummelling the servilely smiling, chrome-plated Servo. His frenzy abating, and nothing accomplished but sore toes and barked knuckles, he grabbed for his hat (which Servo neatly placed on his head), for his brief-case (which he found being tucked under his arm) and started for the door,

which was being opened for him by Servo, smiling his eager smile.

The rest of the day went as badly as the beginning. The morning was taken up by one of the interminable conferences which he despised, and accomplished precisely as little as they always did. His emotional upset of the morning prevented his eating more than a spartan lunch of milk and crackers; and in the afternoon he made a bad error in his calculations which was duly pointed out to him by a carefully unsmiling subordinate.

Wearily that evening, he dragged up the stairs to his door, which was instantly opened by the smiling Servo, his briefcase whisked from under his arm, his hat placed on the hat-tree, his cigarette lit, his slippers placed on his feet and the paper handed to him open at the chess problem.

Angrily he rustled it over to the financial page which

he never read. At least he'd have some independence! Having asserted himself for some minutes, he flapped it back noisily and, immersed in Maestro's Daily Problem, allowed Servo to lead him unprotesting to the table and gently insinuate his chair under him. Deep in the misleading position of the white queen's bishop, he lifted his soup spoon to his mouth and instantly erupted in an outburst of heartfelt profanity.

Having relieved his feelings, he mopped his streaming eyes, took a sip of water, and prepared to return more warily to the attack. It was his favourite potage, an adaptation of bouillebaïse

prepared by a chef of heart and discrimination.

It was with a roar of genuine anguish that he saw the placidly smiling Servo, bearing the offending bowl aloft, advancing inexorably toward the disposal unit. Maddened, he galloped frantically after, arriving just as the last of the monumental creation gurgled away forever.

It was too much. Dropping heavily into the nearest chair, he said sonorously: "I wish I were dead!"

And smiling his eager smile, Servo picked up the ice-mallet from the sideboard, and unhesitatingly obliged him.

all about EVOLUTION

BY JOHN TAYNE

WE are not here going into the question of whether evolution happens. We will assume that it does, and then go forward to ask *how* it happens. There are several theories about this, some of them attractive, all of them interesting, none of them fully covering the facts. Thus we admit at the outset that we do not know precisely how evolution happens, but that we've got a fairly general idea, and that at least we know the general trends of evolution.

Many people if asked what evolution is, would say something about its making animals and plants bigger and more complicated in structure. This is not always what happens. Often a creature evolves

to something smaller and less complex—most parasites are examples of this. Rather more learned people might say that the really constant feature of evolution is that it enables creatures to live more efficiently under the same environment or to survive under a different environment. This, again, is not always true, for some evolutionary trends lead to death of the individual and extinction of the race. What, then, comes your heart-cry, *is* evolution?

The only thing we can say about it that is always true is that evolution changes the form of creatures. Sometimes the change is towards more complexity, sometimes it is not, sometimes it is towards

less complexity. Sometimes the change is beneficial to the organism, sometimes it is not, sometimes it is disadvantageous. If the change is beneficial or towards greater complexity, or both, we have what is "commonly" called evolution: progress to "higher" states. If the change is towards less complexity or is disadvantageous, or both, we have what biologists sometimes call retrograde evolution. If the change is not towards greater or less complexity, or not beneficial or disadvantageous, or both, we have, by appearances at least, static evolution. Of course, the decision as to what constitutes complexity, benefit or the absence of these two things is very much an arbitrary one, though most people who know anything about it tend to agree on these points.

So now we know what kinds of changes evolution may produce. How are they produced? The two most fundamental and incompatible

theories are: (a) inheritance of acquired characters; (b) natural selection operating according to various laws that have not yet been fully agreed upon.

The inheritance of acquired characters is quite an old idea which received what everyone thought was a death-blow when the possibility of mutations (see below) was discovered. But recently, some eminent biologists, such as Wood Jones, have expressed doubts about its impossibility and have pointed out what appear to be good reasons for its probability.

The theory states, broadly, that if an organism is affected by its environment to such an extent that its body is in some way changed, it will transmit the change to its offspring. The classical example is the giraffe, the idea being that a long time in the past giraffes had short necks, but by continually stretching up to eat leaves from trees

they made their own necks slightly longer and passed on the "stretch" to their offspring, generation by generation, the necks getting longer and longer, until the present-day monstrosity was evolved. The giraffe is chosen for ease of description; even avowed "acquiredists" do not think this is what really happened to that animal. But they think similar things happened to other creatures.

This theory is difficult to refute, either experimentally or theoretically. Experiments with rats and flies (quick breeders) have shown that no acquired characteristics are exhibited through sixty-nine generations during which the environmental change is applied. But, as Wood Jones points out, what is sixty-nine generations? "Non-acquiredists" maintain that evolution to a significant—*i.e.* recognisable by man—degree may take many millions of years and thousands of generations. Therefore, they cannot trounce

the opposing theory with a mere sixty-nine.

In the opposite camp, the champions of natural selection maintain that changes occur in the reproductive cells of an organism which, while having no effect on that organism, cause changes in that organism's offspring. These changes in the reproductive cells are of several different types. Mutations are one of them. In mutations, something in the environment—cosmic rays, heat, cold, radioactivity—produce changes in the gene structure of the chromosomes in the reproductive cells. Since the gene structure of the parent determines at least half the structural features of the offspring, it is easy to see that mutations may result in the production of offspring who are slightly different from their parent—say a slightly bigger wing in flies.

If the small change is beneficial, or even if it has no effect on the offspring's life, the organism will live to

maturity and produce offspring with the same slightly bigger-than-normal wing. And so the new trait will be handed on, theoretically, for ever. But somewhere along the line an organism with the slightly bigger wing may suffer a similar environmental change (mutation) as that suffered by the original parent. And in the same way, it itself will not be affected, but its offspring will be. *These* offspring may have wings which are slightly bigger than the slightly bigger ones. When this process has happened several times, the wings of the most recent generations are considerably larger than the wings of the remote original parent—so much larger as to form a new species. Evolution has been accomplished.

If a mutational effect is not beneficial but actually harmful, the offspring will probably die before reaching maturity and, therefore, will produce no offspring to perpetuate the harmful feature. A muta-

tional effect that may start off as neither harmful nor beneficial is not likely to stay that way for long. In the case of the gradually enlarging wing, for example, there would come a point where the size of the wing is an embarrassment to the organism; it would not be successful at living and would produce no offspring. There is little doubt that all mutational effects are, in the long run, disadvantageous, though many may pass through a beneficial stage. The species that thrive today are those which have not had their mutational trends carried to extremes. The present-day species which are ill-adapted, such as the orangutan, are those in which extreme alterations that were once beneficial are now harmful and are killing off the race as surely as if a gun were used.

This question of a mutational effect being disadvantageous or beneficial is what is meant by natural selection. Stated rather un-

precisely, it means that nature selects for survival those organisms which are most fitted to live. Taking the reins out of nature's hands and describing the process more exactly, we can say that organisms with disadvantageous mutational trends are less able than their non-mutant fellows to compete in the struggle for personal survival (search for food, etc.) and for racial endurance (search for a mate); they, therefore, tend to die out before producing offspring. Conversely, those organisms with advantageous mutations tend to "crowd out" their less fortunate fellows.

Mutations are only one way, so some experts believe, by which natural selection is instigated. Another is change in chromosomes by "accidents" during cell division. During division of the reproductive cells the chromosomes undergo a great many changes, being rearranged in the cell, split longitudinally and generally knocked about.

As this process goes on bits of chromosomes are sometimes broken off and become joined to another, with consequent effect on the organism which develops from that cell. Thus, though the effect is the same (evolution) and the raw material is the same (chromosomes), the initial cause is probably not the same.

This question of causation of chromosomal changes is one which is engaging the attention of a great many biologists at the present time, for it strikes at the very roots of scientific belief. Quite a few well-known and highly experienced geneticists believe that there is no cause in the usual sense of the word. They believe that mutations and chromosome "injury" happen by chance. The idea of chance is something that scientists like to deal with only when it is expressed in strictly mathematical form—it then is more a measure of probability than of randomness. But this concept of

chance mutational evolution is completely non-mathematical and most disturbing. Science of any kind is based upon the one basic and hitherto unquestioned assumption that everything has a cause. This, scientifically, means that every event is the inevitable result of a previous *significant* event. The "significant" part of it is important, for nobody believes that mutations are causeless in the sense that nothing happens to give rise to them. The modern revolutionary view is that although there is an event which produces a mutation, that event lacks significance and the subsequent event (the mutation) is not the inevitable result of that previous event.

In other words, it is being held that one kind of event (say collision of cosmic ray with gene) may at one time produce a certain kind of mutation and at another time produce a different kind of mutation or none at all. All this has been derived from the

results of the most careful experiments in controlled mutation that scientists of international fame can devise.

Time and again geneticists subject an organism (usually the fruit fly, *Drosophila*) to an agent (say, radioactivity) that is known to cause mutations. However much they try to make the conditions uniform—and this is a high art these days—they are never sure of getting the same kind of mutation. They may in one experiment produce a slightly larger eye. By repeating the experiment as exactly as they can, they may be presented with a few different pigment spots in the wings. If they continue the experiments long enough they get the slightly larger eye again.

But at no point can they say why it is that they have produced the larger eye on two occasions but not on the other occasions. As far as they know, the conditions of each experiment were absolutely

identical. They have gone to amazingly complicated lengths to effect this, but still they get chance, or random, mutations.

Similarly with chromosome "injury"; there seems to be no "reason" (as distinct from cause) why a particular division should result in a change of chromosome structure whereas millions of other divisions, going on alongside, do not result in changed chromosomes. The reproductive cells are all packed tightly together on a microscopic scale. In controlled experiments they have been screened from every possible outside influence. Theoretically, every cell should behave the same, within very narrow limits. Yet now and then, for no apparent reason, one of

the cells decides to change its chromosomes.

All this ties in with the Heisenberg theory of uncertainty, which also expresses in a scientific way the idea that things happen randomly. It is based on the apparent fact that although one can predict when a given mass of radioactive atoms will have decayed, one is theoretically unable to predict the decay of any single atom—because its decay is causeless or random.

Such is the modern attitude to evolution. Far from its being looked upon as a miraculous feat of "nature," it is considered to be the workings of pure chance. We are what we are for no better reason than that we are!

John Stuart Mill

by H. J. CAMPBELL

In several ways John Stuart Mill was like Aristotle, with whom we dealt last month. Mill had not the power and range of vision and insight that mark out Aristotle from all men before or since. But he did possess the same capacity for being wrong about so many things and being right about so many others.

Mill was a philosopher and logician. He did very little experimental work; some would say none. But he was a vociferous exponent of the experimental method for other people. It is to him that scientific method owes several basic principles, which we shall enumerate presently. For the moment, we must add that the greatest effect Mill had on the development of science was in promoting fertile controversy. Because he had a thorough grounding in Aristotelian deductive logic, Mill's pronouncements were looked upon by many as *having* to be true. Those who thought more deeply were required to examine their beliefs afresh so that they might be more clearly stated in order to refute

Mill's doctrines; and in the process, these deep thinkers were forced to think even deeper, with resulting new discoveries that might have remained hidden from less belligerently-stimulated minds.

No one doubted that Mill's principles of scientific method—"canons" he called them—were ideal and true as working guides. The controversies raged over his more fundamental explanations of the use of these principles. In Mill's view induction—roughly, scientific method—was a process whereby one started off with a lot of isolated facts, thought about them a lot and thereby arrived at general principles which explained the facts and would serve for all further inductions. He just could not see that such a process would be utterly illogical because merely "thinking about them a lot" is not a patterned process, and cannot, therefore, formally be shown to be valid.

Mill's canons, of which there are four, laid down clearly and precisely for the first time—although the

methods had been used but not formulated long before his time—the conditions necessary in an experiment to track down the actual causation of an event. Thus, while people like Bacon and Newton had tried to impress on scientists the necessity for experiment but had not told them just how to do it—probably because they were too busy with their own experiments—Mill stayed away from the bench but worked out a blue print to enable the laboratory worker to spend his time profitably. By using the four canons, which have been added to since, the early scientists were placed in a firm position for stating the casual relations between the phenomena on which they were working.

The series of articles on scientific method that will follow the present series on logic will deal fully with such matters, so here we will simply state the canons. They are so obviously fundamental that further comment would not be required from our point of view.

Method of Agreement: "If two or more instances of the phenomenon under investigation have only one circumstance in common, the circum-

stance in which alone all the instances agree is the cause (or effect) of the phenomenon." *Method of Difference:* "If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two instances differ is the cause (or effect) or an indispensable part of the cause, of the phenomenon." *Method of Concomitant Variations:* "Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation." *Joint Method of Agreement and Difference:* "If two or more instances in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance, the circumstance in which alone the two sets of instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon."

MEDICAL PROGRESS BY A.D. 2000

From Dr. P.Z.H., M.D., Birmingham. (Full name and address withheld by request.): Might I crave the hospitality of your excellent magazine to level a certain amount of criticism at Mr. Jackson on his article on medical progress (No. 45). While it is true that your contributor's effort is on the whole fairly well-informed, some of his statements will bear correction, if your science-avid public is not to be misled.

I would agree that present-day anaesthetics are far from perfect, though certainly a considerable improvement on Simpson's chloroform dropper. Mr. Jackson's views on muscle relaxation seem to me to imply, however, that he ignores the necessity for a *selective* relaxation: that is, the respiratory semi-voluntary muscles must not under any circumstances share the paresis-producing effect of all curariform myodepressants unless one desires an asphyxiated patient. And curare has been in use for over two years in the theatre, as well as for centuries in the jungle.

Mr. Jackson's implication seems to be that streptomycin is largely an experimental antibiotic: "future

experiments with streptomycin will eventually provide the answer."

Might I point out that not only has "strep" been tried for over ten years, but I'm afraid that in some respects it has been found wanting, notably in its tendency to produce drug fastness, being in this respect quite the pleasantest antibiotic from the point of view of our disgusting little *Mycobacterium tuberculosis*. I should have thought that some mention would be made, in addition, to the valuable help afforded the treatment of T.B. by P.A.S., I.N.A.H., and other drugs in conjunction with streptomycin. Full marks to Jackson, however, for his emphasis on the nutritional, sociological and other aspects of the disease.

At the risk of appearing unpatriotic, I have to point out that to my knowledge, a few years before Ewins gave us sulphanilamide, Domagk, in Germany, used the sulpha prototype, prontosil, with good effect—this is not to minimise the excellent work done by our workers in the field, but to give honour where it is due. Mr. Jackson's statements about the treatment of pneumonia seem to imply

a belief in only one aetiological cause of the pathology of lung inflammation. In point of fact the various antibiotics are now quite successfully the treatment of choice of the various pneumonias—the very small percentage of deaths are due either to extreme age, hypostosis, or late treatment. A typical (primary) viral pneumonia is always amenable to either aureomycin or chloramphenicol.

And why, may I ask, when Wohler's synthesis of urea, which dealt the death blow to the vitalistic theory of organic chemistry is mentioned, as well as Schramm and Woodward's synthesis of simple proteins, why is it that Emil Fischer's monumental work in the amino acid analysis of protein is apparently ignored? And might I point out that though science fiction stories about androids may be enjoyable, I personally have strong doubts whether fifty or even five hundred years will be long enough to produce artificial life in the full sense of the word. But that is, of course, only an opinion.

As a last item, to which you may or may not attach equal weight with the above, I have to administer a stern rebuke to our excellent Mr. Jackson who believes that Medicine will work itself out of existence, who

dreads that surgery will regrettably always find patients for its advanced skills, yet seems to ignore the ineluctable scope of obstetrics.

From C. V. Jackson, F.R.S.A.: In attempting to cover such a broad field on the small canvas offered by a short article there were omissions and generalisations of the type referred to by Dr. H. Since this set out to be a semi-prophetic article I attempted to mention the various important fields of Medicine in such a way that readers would realise just how much medicine has already accomplished in certain directions, and provoke them to a little quiet thought about what the next fifty years could well bring. Perhaps man will fall prone to even deadlier diseases than those we already know. Maybe as fast as medicine banishes one family of microbes there will arise newer, more virulent forms to say "Come on in, boys, the blood's fine!" Perhaps nature will provide an answer to a grossly over-populated planet by scourging the Earth with serious famine and disease. Or perhaps Man will have finally conquered space and will be ready for mass migrations to other planets—who really knows? But there's no harm in a little quiet prophecy of our own!

From H. J. C.: This kind of thing can be disputed for eternity, but we just haven't the space for it. While we are sincerely grateful to Dr. H. for taking the trouble to write to us at length, and hope that he will continue to keep an eagle eye on our medical features, we feel that, to keep the record straight, we should point out a thing or two ourselves.

1. Curare has certainly been used in theatres for two years, but only sporadically and not by any means as a routine. Is Dr. H. aware that the Home Office must be notified about every single use of curare—*before* it is used? Also, of course, there is no danger with paresis of the respiratory muscles, providing adequate artificial respiration is effected. 2. All scien-

tists work on a basis laid by earlier workers, Domagk no less than Ewins. But Ewins gave us M & B 693 (sulphapyridine, not sulphanilamide) which is still in constant use, whereas prontosil is hardly used at all nowadays (693, by the way, is the number of experiments Ewins performed before he synthesised sulphapyridine). 3. Pneumonia is *never* treated with antibiotics alone; always in conjunction with M & B, or one of its allies. 4. With respect to artificial life, Jackson carefully pointed out that he was not referring to "life in the full sense of the word." 5. Obstetrics, which is the science of childbirth, can surely have nothing to do with injury by accident and the consequent need for surgery.

This correspondence is now closed.

*Have you reserved your copy
of*

**THE AUTHENTIC
BOOK OF SPACE**
SEE ANNOUNCEMENT ON PAGE 141



FICTION

A goodly collection of longish short stories is to be found in **EDITOR'S CHOICE OF SCIENCE FICTION**, compiled by Sam Moskowitz with assistance from various American magazine editors (McBride, 200, East 37th Street, New York 16, N.Y., U.S.A. \$3.50). The price is a bit steep maybe, for the stories are not really top grade. Each of the editors has selected a story that he considers to be worthy of hard-cover preservation. In theory, that is fine. But the hidden limitation is that most of the best stories have already been anthologised and could hardly be used again. So it is that quite a few of the stories in this

volume come from way back when, and do not represent science fiction as it is to-day. The book must be read in that light, and then is seen to be a distinct contribution to science fiction literature. Since some of the stories are legendary, and only difficultly available elsewhere, we will give a full list of the contents: *The Wall of Fire* by Jack Kirkland, *What Thin Partitions* by Mark Clifton and Alex Apostolides, *I, Robot* by Eando Binder, *And Someday to Mars* by Frank Belknap Long, *Wall of Darkness* by Arthur C. Clarke, *All Roads* by Mona Farnsworth, *Exit* by Wilson Tucker, *The Sublime Vigil* by Chester D. Cuthbert, *Far Below* by

Robert Barbour Johnson, *Death of a Sensitive* by Harry Bates, *The Demoiselle d'Ys* by Robert W. Chambers, *Stolen Centuries* by Otis Adelbert Kline.

Another anthology from Grayson & Grayson (16, Maddox Street, London, W.1. 9s. 6d.) maintains their high standard of selectivity. This one is called **THE ROBOT AND THE MAN**, and is edited by Martin Greenberg, a man who really knows his science fiction. There are ten stories, each one about robots and their effects upon humanity, arranged in a chronological sequence to give the effect of a kind of history of the rise of robots. Somewhat reminiscent of *I, Robot*, Asimov's masterpiece, this book yet manages to be individual despite the fact that ten different authors wrote the stories. Such is a testimony to the perception and wisdom of the editor. Authors include Lewis Padgett, A. E. van Vogt, Lester del Rey and Robert Moore

Williams. Well worth reading, and keeping.

Museum Press is certainly slipping up in its choice of reprintable American science fiction lately. The first downbeat selection was *The Humanoids*, and now we have **DRAGON'S ISLAND**, by the same author, Jack Williamson (9s. 6d., from 63, Old Brompton Road, London, S.W.7). We reviewed the American edition of this book in our issue No. 13, and neither our views nor the book has changed since. On the whole, it's not a really bad story, but it certainly is not science fiction. It's all about some remarkable mutants turning up in New Guinea and, as the publishers say, is a "mixture of reality and imagination." There's rather more imagination than reality, but then, some people seem to like that kind of thing. If your desire for credibility is not so great that you do not boggle at rocketships growing like cherries on trees, then you may like this story. For our part we hope

that future Museum selections will get back to the standard of their earlier titles, *The Blind Spot*, *Dreadful Sanctuary*, *Gateway to Tomorrow*.

The trouble with people who try to get in on a successful act is that they rarely take the trouble to learn their lines. This is a sin of omission on the part of Captain W. E. Johns who, after turning out some twenty-seven juvenile books such as *Biggles* and *the Black Raider* and *Gimlet Mops Up*, has now

jumped on the science fiction waggon with **KINGS OF SPACE** (Hodder & Stoughton, Warwick Square, London, E.C.4. 7s. 6d.). Though this is a fast-moving story of considerable power (the plot is standard juvenile adventure), the sheer stupidity of the inaccuracies is likely to undo a lot of the good that education does. We believe that a story can be made exciting without dragging in Armadillos as natives of the Moon and Brontosauri as inhabitants of Venus. Such things abound in this book.

NON-FICTION

If there are still people about who are not tired and sick of all the nonsense that has been written and spoken about flying saucers, they will probably be interested in **FLYING SAUCERS FROM OUTER SPACE**, by Donald Keyhoe, which costs 10s. 6d. from Hutchinson (Stratford Place, London, W.1). Keyhoe, you will remember, wrote the booklet called *The Flying Saucers are Real* a few years back. This present piece

from his pen seems to be a kind of new and more expensive edition of the earlier book, with the addition of some more recent sightings and wads of the conversations that arose out of them. Naturally, nothing definite comes out of it all—except, perhaps, the not very brilliant opinion of a U.S.A.F. spokesman that “if the UFO’s (unidentified flying objects) are not caused by some strange natural phenomena, they are

interplanetary." Nevertheless, the book flows fairly freely and would serve for something to fix the eyes on when there's nothing more important around. Three-quarters of the book are taken up with what Keyhoe said to the Air Force and what the Air Force said to him. It shows one thing, at least: Keyhoe has a remarkable memory for dialogue.

An interesting and quite scientifically-written book by D. J. West is **PSYCHICAL RESEARCH T O - D A Y**, which is put out at 12s. 6d. by Duckworth (3, Henrietta Street, London, W.C.2). This is an essential book for anyone who is the least bit interested in science, for it covers most adequately the present state of knowledge in the comparatively unexplored region at the fringe of orthodox science. West has spent a lot of his life looking into these matters. He is a trained scientist and he presents his material with an admirable tinge of scepticism. All the renowned cases of spontan-

eous psychic impressions are described, together with many famous examples of mediumship. Thorough treatment is given to E.S.P. in its various forms, poltergeists, dowsing, stigmatisation and apparitions. The author reports extremely well and dogmatises but little. The only faults we find are in the last chapter, in which West tackles the thorny subject of theory, and even there we can disagree with him only on matters of opinion, not of fact. A really excellent book which is very highly recommended to all our readers—especially those who approach psychic phenomena unscientifically!

J. G. Crowther has spent most of his life writing popular science that even professional scientists respect. His latest book, **THE SCIENCES OF ENERGY**, comes at 12s. 6d. from Frederick Muller (110, Fleet Street, E.C.4) and is described, correctly, by the publishers as a commentary for the general reader on the recent advances in astronomy,

physics and chemistry. Popular science to-day is much more difficult to do properly than it was when Crowther first began writing it, but he has retained his old knack of making complex things appear easy — a perfectly legitimate thing for those who are not going deeply into the subjects. So it is that Crowther takes these three sciences and puts them across in terms of their recent knowledge and their implications to the practical world around us. From the point of view of science fiction readers, the main interest is the author's extrapolative treatment of society of the future. We confidently recommend this book to those readers who feel that they are not sufficiently *au fait* with modern scientific developments.

We have a special penchant for books that present their subject with the minimum of circumlocution and the maximum of at-a-glance layout. Such a book is **OUTLINE OF CHEMISTRY**, by E. J. Manton, which Blackie

have published at 5s. (17, Stanhope Street, Glasgow, C.4). Here, in only about 140 pages, is the basic skeleton of organic, inorganic, analytical and theoretical chemistry. Wordage is reduced to the bare essentials and the exposition is thereby uncluttered. Formulæ and equations are set out in easily readable fashion, and there are many numerical examples, fully worked out, where these will do most good. This book could make all the difference to anyone battling with the ordinary chemical texts, though naturally it covers only an elementary field.

The many readers who have expressed themselves as grateful for Frank Wilson's articles on logic will be pleased to know that there is now available an inexpensive little text that considerably amplifies the material in our articles. This is **LOGIC IN PRACTICE**, by L. Susan Stebbing (Methuen, 36, Essex Street, W.C.2. 7s. 6d.). Stebbing was professor of philosophy at London University

before she died, and she had a tremendous gift for presenting this subject stripped of its traditional frustrations. Her more advanced works are standard university textbooks, but this one is for "ordinary" people. As the title implies, it tackles logic from the point of view of its use in life, and thereby becomes something that most of us can read with profit. We highly recommend this little book to all our readers and predict that many of them will have to change some of their ideas when they have read it!

SPEEDING INTO SPACE

is another of Marie Neurath's colour books for children put out by Max Parrish at 6s. (55, Queen Anne Street, W.1). Though presented simply and highly dramatically, the story of space flight as expounded in this book is quite accurate, having been checked by Kenneth Gatland, of the British Interplanetary Society. A useful book for readers who want to bring up their children with the right ideas!

SCIENCE NEWS No. 32 (2s., Penguin Books, Harmondsworth, Middlesex) contains several articles which would interest most of our readers, and quite a few would be intrigued by all the articles. Perhaps the most apposite for devotees of our kind of literature is that by the Astronomer Royal, Sir Harold Spencer Jones, on Continuous Creation. A. M. Mayer's piece on the mass culture of chlorella gives the scientific background to spaceship and satellite farms. A most absorbing philosophical piece comes from Bernard Mayo on the Existence of Theoretical Entities.

NEW BIOLOGY No. 16 (2s., Penguin Books, Harmondsworth, Middlesex) is especially recommendable for its symposium on the origin of life, with contributions by J. B. S. Haldane, J. D. Bernal, N. W. Pirie and J. W. S. Pringle. All who are in the least interested in this subject will find much here to stimulate thought and argument.

MARCH of SCIENCE

A review of recent developments and ideas in science

Experimental biology has taken quite a big step forward in the laboratories of the Division of Animal Health and Production, Glebe, Australia. Although the phenomenon of making an unfertilised egg cell divide by "irritating" it has been known for a very long time, it has only been possible to carry out this operation in the lower animals. The sea urchin has been the favourite organism for many years, and then the frog's egg was found to respond in a similar manner. But a frog is still pretty far down the scale. Drs. C. R. Austen and A. W. H. Braden at Glebe have now shown that the egg cell of the rat can be made to divide by subjecting it to extreme cold. This is the first time that such a highly placed animal (a mammal) has responded to

such treatment. There have been a few half-successful results with rabbit eggs, but even the rabbit is lower evolutionarily than the rat.

The interest of this type of work for science fiction readers is that it is probably the first halting step towards the production of humanoids (using that term to mean the making of artificial living creatures, not necessarily human) though the researchers would probably scoff at the idea!

AUTOMATIC FACTORIES

It would be difficult to assess the number of science fiction stories in which automatic factories feature prominently or as part of the background. Such factories are often the target for adverse comments against

science fiction—the idea being considered by the layman to be completely crazy. These doubters may be somewhat surprised, then, to hear that a body no less august than the National Physical Laboratory (Light Division) is working in collaboration with an industrial firm in the production of diffraction gratings that are designed to be the first step in the setting up of an automatic factory.

The theory behind this venture is rather too complex to go into here, but roughly the idea is to use diffraction gratings to control the work of machine tools. It has been found that, with certain special kinds of grating, control of these tools is infinitely finer than that effected by even the most experienced workman. In the automatic factory being projected, taped instructions will be fed to the machines and the degree to which they obey the instructions will be watched by the gratings, and any changes necessary relayed via elec-

tronic devices to the power supply.

ISOTOPES

Though America tends, by its bigness and its tremendous resources, to out-produce Britain, this is being proved not the case where radioisotopes are concerned. Britain is leading the world with the range and amount of these materials it is producing for international consumption. Now, the world-wide demand for British isotopes has risen to such an extent that special buildings have been lately erected at Amersham specifically to produce these valuable research and control tools. The main production lines are radioactive iodine and phosphorus,* but a considerable number of other radioactive elements are made, as well as an increasing range of aminoacids and proteins, together with animal foods containing tracer elements. The effects that these isotopes will have on the progress of science in laboratories

throughout the world would be difficult to calculate. It is nice to know that Britain, in which radioactivity was discovered, is supplying the raw material for the acquisition of so much new knowledge.

HOW DO WE SMELL?

Physiologists and chemists alike have always been baffled by the different types of odour that are distinguished by the human nose. The physiologists have not been able to find an explanation in the taste buds (which register only salt, sour, sweet and bitter) and the chemists have been unable to relate the structure of compounds to their odours. From recent work carried out by Dr. E. D. Adrian at Cambridge, it seems that the major difficulty was the philosophical approach. Scientists, Dr. Adrian believes, have been looking at the problem from the wrong point of view, including himself. His experiments indicate that it is the nerve cells themselves which

differ in their chemistry and which, therefore, react differently to different chemical stimuli. These nerve cells are actually in the brain. By inserting electrodes into them, he has found that some cells discharge when one stimulator is used, and other cells, maybe adjacent to the first, discharge when other stimuli are used. Whereas traditional physiology looked upon all cells having one function (olfactory, in this case) as having one response, the new view which Dr. Adrian puts forward, and which will undoubtedly be accepted in the light of his results, looks upon each cell as a chemical entity, capable of responding to its own particular "complementary stimulus." It seems that at last we are getting near a solution to the age-old problem of how we smell—transitively speaking!

THE GREEN OF MARS

There has been much dispute about whether the green areas of Mars are caused by

plants. Spectroscopic evidence has always been considered to be against this view, since the spectra of the Martian greenery is very different from that of ordinary terrestrial plants. Not too long ago, Kuiper, the American astronomer, pointed out that the Martian spectra were quite similar to those of terrestrial lichens, so opening up once more the possibility that Mars possessed plants that had equivalents on Earth.

More recently, G. A. Tikhov, of the Astrobotany Laboratory at Alma Ata in Russia, has provided additional indications that this may be so. Tikhov reasoned that since Mars is a cold place, if it had any plants at all they might resemble those in cold regions on Earth. So he carefully measured the spectra of plants growing in sub-arctic and high alpine

conditions—and found that in all essential points there was agreement with the Martian spectra. Though this does not prove that Mars possesses higher green plants, it does show that this is not impossible.

Tikhov puts forward a rationale on the grounds that Martian plants would have adapted themselves to the cold just as terrestrial plants have done. In that case it is quite likely that the chlorophyll pigmentation would be modified in some way to increase the absorption of red and infra-red rays, which are the wavelengths that carry most energy (i.e., warmth).

It is certainly an attractive theory, and goes a long way towards making everyone happy about those green areas. But it still is not proof. Still the only way of finding out for sure is to go there and see!

FANZINES

Reviewed by H. J. C.

Once, I was not all that strong on belief in miracles, but now I won't bat an eyelid to any that come along. The reason for this change of heart is that London now has a fanzine.

For long, London, with the biggest single fan group in the world, has been behind the youngest, smallest groups in this respect. Now, thanks to some heavy spadework by Stuart McKenzie, E. C. Tubb and Vincent Clark, the metropolis can boast of a publication all its very own. These three are its editors—Stuart having come in from *Space Times*, which died under peculiar circumstances that I haven't yet got to the bottom of, and which may have been resuscitated under new management by now.

Anyway, here we have *i*, as tenuous, amorphous, aimless and proteus as the London Circle itself (see page 105 in

this issue). *i*, by the way, is the mathematical symbol for the square root of minus one, which, if you think about it long enough, drives you mad, for it has no real existence. But *i* is not to be looked upon as an official organ of the London Circle—nothing as formal as that, by jove! Nor does it intend to be consistent. Each issue will differ as much from the ones before it as the editors can manage—and I hear they have a few nifty dodges up their sleeves.

One rather remarkable difference between *i* and all other fanzines is that it is not sold by subscription, in case you don't like it once you've paid your money. What you do is, fill up a coupon and send it with 1s. 6d. for the next issue, and so on until you or they tire of the arrangement. Typical London approach, this. Good, too.

As for content, well, the

first issue contains an article by me, so there's really no more to be said, though I'd better mention that co-contributors include Walter Willis, Frank Arnold, E. J. Carnell, and several more whom you know quite well, with, *naturally*, Tubb, McKenzie and Clark. Also, you might like to know that the usual fan dribblings are not contained in *i*, so they say. It is said to be a publication "by the elite, for the elite." That could mean you, too, of course. When I tell you that it's printed on green paper with mushroom men round the edge, you'll know just what they mean by elite.

Being a London publication, there is no guarantee that it will come out regularly or at all, but the buy-as-you-like-it terms take care of that. Since everybody concerned with *i* reads all the science fiction there is, it is understandable that they are not interested in "swapping" with other fanzines. The only way to get it is by paying for

it. Nice and straightforward with nothing to confuse the neofans. Printing is limited each issue to 200 copies, and anybody who sends in money after they've all been sold will get it back. The editors also reserve the right not to sell it to anybody they think is not an acceptable reader, though what basis of selection they will use God only knows.

i is in extremely capable hands, and it could be that this fanzine will reach the top of the tree. The main hazard to the life and progress of a fanzine has been shown to be squabbles among the editors. We think that this, at least, is most unlikely to happen in the case of *i*. We are really overjoyed at its appearance, and we very sincerely wish it the very best of luck for the future. And we hope that every single reader will forthwith send off 1s. 6d. to J. Stuart McKenzie, 5 Hans Place, London, S.W.1. (If you mention *Authentic* you will probably be accepted as an acceptable reader!)



Projectiles

OVERSEAS SECTION

CONSISTENT

I would like to congratulate you on the consistently high standard of *Authentic*. Being now a reader and collector of some fifteen years' standing, it needs to be a really good story to draw any praise from me, and such a story was *Tomorrow is Another Day* by K. H. Brunner in No. 43. There have been many other landmarks previous to this, but this one was really good. Please keep to your style of covers; they are a real feature and amongst the best of any on the prozines today. Your departments are very much a feature, too.

Donald H. Tuck, 17 Audley Street,
North Hobart, Tasmania.

Thank you for the kind words, Donald. Coming from a man with your experience, they really mean something. Let's hear from you again, please.

ATROCIOUS—ONCE!

For twenty-eight issues your covers were atrocious and the stories were pretty crook, too. I kept on buying them, mostly because they were about the only STF available in Australia. I got the first 12 issues in England before I emigrated down under. With the advent of No. 29 the covers underwent a tremendous improvement and there appeared in the next nine issues a number of stories comparable with the best in American sf. Imagine my annoyance when, on returning from National Service and catching up on issues 39-42, I find that once again the covers have changed and you are now using a cross between the original and second type. If you are going to keep on doing this will you do us poor fans a favour and keep the same type and colour of spine? One of the great pleasures of my day is to wake up in the morning and see the rows of mags in my bookcase, each nicely separated and distinctive by its spine.

If you print this, you might

mention that if there are any youngsters in the Newport area of Melbourne who can't afford magazines, they can always borrow mine from this address.

Ken Potts, 307 Douglas Parade,
Newport, Melbourne, Australia.

Ah, but, Ken, isn't variety the spice of life? We hope impecunious Melbourneans will take advantage of your kind offer. That's the spirit we like to see in fandom.

IDEAS

The non-fiction portions of the magazine are good, but the science articles appear to be either too condensed or too vague and wandering. In future issues what about cover views of the solar system, particularly Saturn, one planet per month? I would suggest for science articles the following subjects, based on present-day scientific knowledge: robots, future human foods, evolution, planetary gravitational fields and their dangers, humans and the effect of gravity on other planets, and future power sources and resources.

R. J. Burgess, Romita,
11 Childs St. Clayfields, N.2.
Brisbane, Queensland, Australia.

Many thanks for the ideas, Roy. The solar system cover series will be starting with the next issue—we already had it planned when your letter arrived. As for articles, some of the subjects have been covered by now and some of the others will

be appearing in future issues; the one on evolution is in the present issue. Okay? Keep up the good work. We like to pick readers' brains!

DIFFERENT

There is no mag State-side that I like better than its editor(s), for if the editor isn't to my liking, neither is his mag(s). In England, however, I like HJC much more than *Authentic*. There are times though when I disagree with him most heartily. He admits that men like Deegan and Sheldon helped to make *Authentic* what it is today; yet he refused to retain them when the mag mutated. To my mind, this is saying that the mag previous to the issue of January, 1953, was inferior to what it is today; yet if it were so it would never have risen to where it is. I have nothing against Temple, Byrne and Phillips. Charles L. Harness has long held a high place with me; *The Rose* was exceptional. But I like the above-mentioned authors equally well.

Henry Moskowitz, Three Bridges,
New Jersey, U.S.A.

Then all you have to do, Henry, is read the Panther Book series in which Deegan and Sheldon regularly appear. Authentic prior to 1953 was not inferior to what it is now—it was different. We have never refused to print Deegan, Sheldon or any of the old authors in Authentic (Deegan had a story in No. 37 and Berry keeps on cropping up), but these authors seem happier in the novel-length form: should we force

them into the shorter forms of Authentic? We're glad you like us, anyway. One day it'll be "love us, love our mag!"

FAIR DINKUM

I feel I must write a few words of praise of your fine magazine. Out here in Australia one is continually swamped with both local and American science fiction, but after reading sf for years I'd say not one of them can hold a candle to *Authentic*. Your science features are also very welcome and interesting. Finally, on closing, once more, best wishes for a "fair dinkum" little magazine.

Alf Summers, 18 Cadogan Street, Marrickville, Sydney, Australia.

Upon our word, Alf, we're glad about that! Hope you keep on liking us. And tell all your friends.

HOME SECTION

AS WE SAID

Re your criticism of ORBIT 3 in *Authentic* No. 45—your sentence "there is a tendency to the adolescent" is a bit thick. I, and surely you, realise that science fiction fans would rather read humorous and "adolescent" material than a lengthy diatribe calculated to appeal to a minority of "big-heads." ORBIT caters for the majority of

fans—the material we publish is for "young" minds—not persons with beards!

George Gibson, Editor ORBIT,
Little London, Aberford,
Nr. Leeds.

Fine! Just as we said, ORBIT tends towards adolescence. Of course, there's nothing wrong with adolescence—among adolescents! But what does the rest of fandom think about George's assessment of the mental age of the majority of fans? The bit about beards we'll ignore in our unearthly wisdom . . .

SCOFFING

I have recently attended a lecture by a Fellow of the British Interplanetary Society, and I found it very interesting but for one thing—he had a bad habit of scoffing at science fiction regarding space flight. Is this a common thing or in the minority? I always had the impression that Fellows of the B.I.S. always looked well ahead to things as they are written about in science fiction. Of course, I know that some tales are far-fetched like some of the superman kind of the American standard.

J. E. Taylor, 40 Spooner Avenue,
Litherland, Liverpool, 2.

And not only American, either, Mr. Taylor. You have put your finger

on the root of the problem. B.I.S. people do not scoff at good science fiction—many of them write it. But they, and all scientific-minded people, get annoyed at the inaccurate nonsense that is so often labelled science fiction. That is why Authentic is authentic.

STAR MAPS

I have been a science fictioneer for many years and there's one thing I have always wished to have, and that is a map of the universe, showing the positions of the stars and planets at the beginning of each month. Is it possible to publish such a map, section at a time or complete?

G. A. J. Matthews, 8 Greenway Drive, Westbury-on-Tyne, Bristol.

Production problems rule out our publishing such maps, Mr. Matthews, but are you aware that The Times puts out a 2/6 booklet each year containing maps and descriptions of the sky for each month of the year? You can get it from most bookshops or direct from The Times Publishing Co., Ltd., Printing House Square, London, E.C.4.

OH!

The series of these covers are good, but a cover such as No. 45 does not hold the spectator. That

cover was empty, bare and uninteresting, even to myself. An unregular reader of science fiction would probably just glance over it and stop his gaze on other magazines, whose covers, as a rule, show lurid pictures of nearly-naked babes or a space-opera type of picture. This 'zine he would probably buy; years ago I did the same myself. Granted we buy our books for story quality, not to sit and gape at the cover, but still a cover should be action-packed and full of interest to draw attention—to attract those people who still buy by the cover.

Don Allen, 3 Arkle Street, Gateshead, 8, Co. Durham.

Don, we couldn't possibly fail to disagree with you less!

YOU BETCHA!

In various magazines readers have written indignant letters about women "poking their nose in." That, in my opinion, is a sign of an adolescent mind. A mature mind will realise that a woman has her place in the scheme of things and that nature intended the two sexes to be complementary to each other, not to be deadly rivals. When space travel becomes a reality and journeys through space may take months or years, both sexes should

make the trips together for the sake of sanity. So let women have their place in this particular type of literature!

Roberta Wild, W.R.A.F., Bucks.

(Full address withheld by special request.)

Sure thing, Roberta, we're all for it! And we've no doubt that by the time space travel becomes a reality, the world will be sensible enough to bring women fully into the picture. The venture will be doomed to failure if they aren't.

TO AND FRO

For every step forward you take, you are going back two. The reason I say this is because you are turning

Authentic into a book of short stories, and are sinking into line with other mags of that type, which I understand is what you wanted to avoid. Why not go back to the old days and give us the old *Authentic*? I have always thought of *Authentic* as my mag, and I would hate to see it sink to the level of the majority of others.

Bob Johnson, 68 Dover Street,
Glasgow, C.3.

*Now, Bob, old chap, aren't you exaggerating a wee bit? You're still getting a long story in each issue—longer than anybody else over here publishes. Of course *Authentic* is your mag—and you know darned well it's not sinking to any kind of level. Come on now, admit it!*

Announcement

A limited number of *Authentic* back issues are available. Nos. 29 to 34 and from 39 to current issue.

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F.C.S., F.R.H.S., M.S.C.I., F.B.I.S.

Foreword by

ARTHUR C. CLARKE

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